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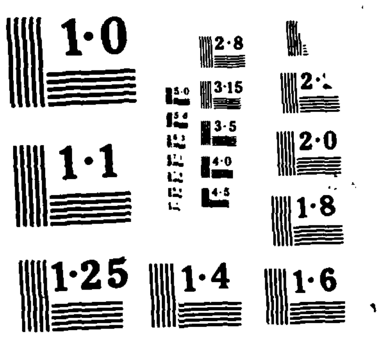
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ARMORED FAMILY OF VEHICLES (AFV) AUTOMATION AND COMMUNICATION RESOURCE MANAGEMENT PLAN (ACRMP)

(Preliminary)

Armored Family of Vehicles Task Force
ATTN: DAMO-AFV-M (Major Buckstad)
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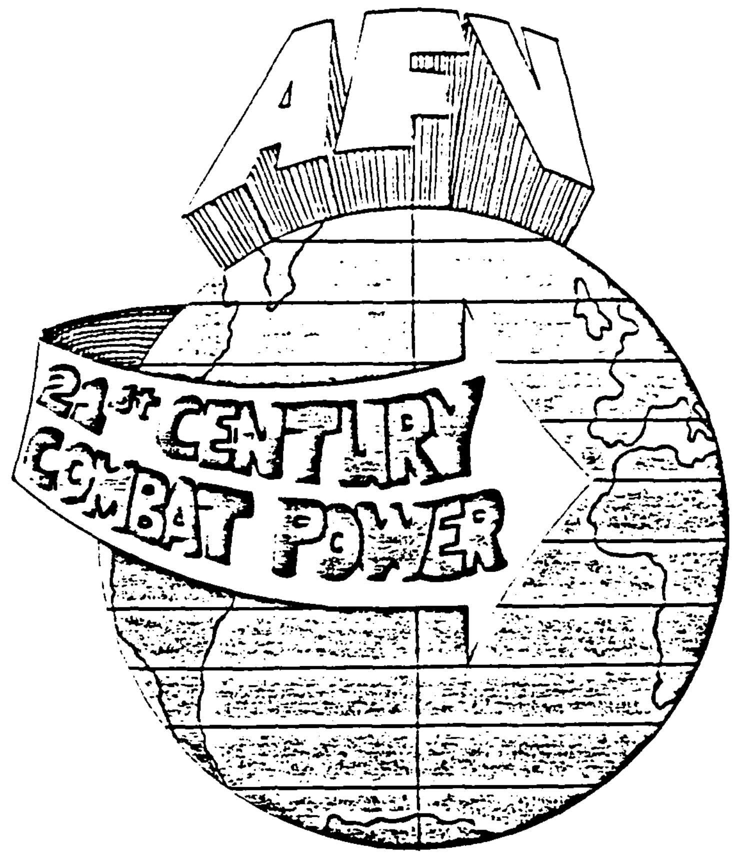
Armored Family of Vehicles (AFV) Phase I Report (U)



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SECURITY CLASSIFICATION OF THIS PAGE

REPORT DOCUMENTATION PAGE

AD-A190934

1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED	1b. RESTRICTIVE MARKINGS NONE
2a. SECURITY CLASSIFICATION AUTHORITY N/A	3. DISTRIBUTION/AVAILABILITY OF REPORT Unlimited
2b. DECLASSIFICATION/DOWNGRADING SCHEDULE N/A	
4. PERFORMING ORGANIZATION REPORT NUMBER(S) Volume 15	5. MONITORING ORGANIZATION REPORT NUMBER(S) Volume 15
6a. NAME OF PERFORMING ORGANIZATION HQDA, Armored Family of Vehicles Task Force 6b. OFFICE SYMBOL (If applicable) DAMO-AFV-M	7a. NAME OF MONITORING ORGANIZATION HQDA, ODCOPS
6c. ADDRESS (City, State, and ZIP Code) Director, AFV Task Force ATTN: DAMO-AFV-M Ft. Eustis, VA 23604-5597	7b. ADDRESS (City, State, and ZIP Code) HQDA ATTN: DAMO-FDD Washington, D.C. 20310-0653
8a. NAME OF FUNDING/SPONSORING ORGANIZATION Same as 6a 8b. OFFICE SYMBOL (If applicable) DAMO-AFV-A	9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER N/A
8c. ADDRESS (City, State, and ZIP Code) see 6c	10. SOURCE OF FUNDING NUMBERS PROGRAM ELEMENT NO. 63645 · PROJECT NO. 408 · TASK NO. — · WORK UNIT ACCESSION NO. —

11. TITLE (Include Security Classification)
ARMORED FAMILY OF VEHICLES (AFV) AUTOMATION AND COMMUNICATION RESOURCE MANAGEMENT PLAN (ACRMP), (U)

12. PERSONAL AUTHOR(S)
Buckstad, Robert D., MAJOR, ADP System Integrator

13a. TYPE OF REPORT	13b. TIME COVERED	14. DATE OF REPORT (Year, Month, Day)	15. PAGE COUNT
AFV Phase I Report	FROM Aug 86 TO Jan 88	1 Sep 87	291

16. SUPPLEMENTARY NOTATION ACRMP is VolumeXV of Task Force Phase I (Aug 86-87) Report. Basic report dated 1 Sep 87, Change 1 dated 28 Jan 88 posted, Change 2 planned Aug 88.

17. COSATI CODES

FIELD	GROUP	SUB-GROUP

18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number)
~~Command & Control, Communications~~ Armored Vehicles, Communications Development, Embedden Automation, Embedded Communications, Vehicle Electronics, Vetronics, (cont'd)

19. ABSTRACT (Continue on reverse if necessary and identify by block number)

The AFV ACRMP is the Task Force Director's (08) tool to manage command, control, communication (C3) automation system life cycle developments for the Armored Family of Vehicles program. Document covers general program background, user requirements, major command and program executive officer responsibilities, development management, acquisition strategy, testing, life cycle support, technology assesment and work group relationships. ACRMP manages evolving C3 and intelligence and vehicle electronic architectures. Document will continue to evolve throughout the AFV life cycle. A major DOD/DA milestone decision is expected in the 89-90 time frame.

20. DISTRIBUTION/AVAILABILITY OF ABSTRACT ☒ UNCLASSIFIED/UNLIMITED ☒ SAME AS RPT. ☒ DTIC USERS	21. ABSTRACT SECURITY CLASSIFICATION UNCLASSIFIED
22a. NAME OF RESPONSIBLE INDIVIDUAL ROBERT D. BUCKSTAD, MAJOR (AV 927)	22b. TELEPHONE (Include Area Code) (804) 878-1465/6 22c. OFFICE SYMBOL DAMO-AFV-M

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Block 18 Subject Tems (continued):

Battalion Command and Control,
Battalion ~~and Below Command Control (B2C2)~~
Vehicle Control,
~~Vehicle Control and~~ Operation System (VCOS)
~~Integrated Automation and Communication~~,
Embedded Training,
Position Navigation,
~~Vehicle Defense,~~
~~AFV~~ Program Management,
~~AFV Automation and~~ Communication Management,
Combat Automation
Combat Communication
Technology Assessment,
Robotics Development Management,
Integration, Automation and Communication,
~~Materiel~~ Development, AFV
~~Combat~~ Development, ~~AFV~~
AFV ~~Life Cycle~~
AFV Project Management Plan
Program ~~Management Plan~~
~~Testing~~
Acquistion Strategy,
B2C2
VCOS
Tactical Automatic Data Processing (ADP), ~~AFV~~

(U) AFV PHASE I REPORT ORGANIZATION

BOOK	VOLUME	TITLE	CLASSIFICATION
1	I II	INTRODUCTION SCP	S S
2	III IV	REQUIREMENTS DOC THREAT	S S
3	V VI VII VIII	LOGISTICS DOC SMMP TEMP RSIP	U U U U
4, 5, 6	IX X	CFP BCE	S S
7	XI	TRAINING	U
8	XII	FEA SPTG DOC	S
9,10	XIII	TECH ASSESSMENT	S U
11	XIV XV XVI	LIGHT FORCES CRMP ACRONYMS/ABBR	S U U

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DEPARTMENT OF THE ARMY
ARMORED FAMILY OF VEHICLES TASK FORCE
FORT EUSTIS, VIRGINIA 23604 5607

REPLY TO
ATTENTION OF
DAMO AFV-M 23 Feb 88

MEMORANDUM FOR: SEE DISTRIBUTION

SUBJECT: Change One, Preliminary AFV Computer Resource Management Plan (CRMP), Volume XV.

1. Reference the memorandum, DAMO-FDD, 20 Nov 87, subject: Armored Family of Vehicles (AFV) Phase I Study Report, with enclosure Volume XV, CRMP, DAMO-AFV-M.

2. An instruction sheet and change one to the referenced volume is enclosed for review and immediate implementation.

3. Summary of changes:

a. Revised milestones.

b. Consolidated Executive Summary.

c. New chapter one, to serve as an introduction and review of the communication and computer resource planned development plans for AFV. Concept Exploration Phase goals are discussed.

d. New title, [preliminary] Automation and Communication Resource Management Plan (ACRMP) to reflect the interconnection of automation and communication resources to support the development of an integrated command, control, communication, and intelligence architecture for battalion and below echelons.

e. New chapter three, to refine command responsibilities to include program management organizations.

4. Point of contact is Major Robert D. Buckstad, Av 927-1465/1466 or (804) 878-1465/63/64.

Encl

ANDERS B. AADLAND
LTC, EN
Executive Officer

DAMO-AFV-M 23 Feb 88
SUBJECT: Change One, AFV Computer Resource Management Plan (CRMP), Volume XV.

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(Pass to AFV C3 and Automation and Communication System Project Officer)

DAMO-AFV-M 10 Feb 88

CHANGE ONE, INSTRUCTION SHEET

Subject: Change One (C1, 28 Jan 88), AFV Automation and Communication Resource Management Plan, dated 1 Sep 87

1. Reference: Memorandum, DAMO-AFV-M, Subject: Change One, AFV Computer Resource Management Plan (CRMP), Volume XV, date: 23 Feb 88, (cover sheet)

2. Instructions:

a. All change one page replacements are dated 28 Jan 88. Make the following page replacements:

Remove, 1 Sep 87	Insert, C1 28 Jan 88 (pages attached)
Executive Summary	Executive Summary.
Chapter 1	Chapter 1.
Chapter 3	Chapter 3.
Table of Contents	Table of Contents.

b. Make the following manual ink changes:

Change from	Change to
"CRMP"	"ACRMP" in all chapters.
"Computer Resource Management Plan (CRMP)"	"Automation and Communication Resource Management Plan (ACRMP)".
Chapter two title, "Requirements Analysis"	"Requirements Definition and Analysis" in all chapters.

3. Summary of changes:

a. The AFV Phase I CRMP has been changed to the Automation and Communication Resource Management Plan (ACRMP) to reflect the necessary integration of computer and communication systems to support a command, control, communications and intelligence (C3I) architecture.

b. Chapter one, General serves as the introduction to AFV automation and communication (AC) system resource management. It has changes to reflect Department of Defense standard events and milestones regarding AC development.

DAMO-AFV-M 10 Feb 88
SUBJECT: Instruction Sheet for Change One (C1, 28 Jan 88), AFV Automation and Communication Resource Management Plan

3. Summary of changes (continued):

c. The ACRMP will continue to receive periodic updates throughout the AFV life cycle. The preliminary ACRMP will transition into its final form after the Concept Exploration Phase and before the conclusion of the Demonstration Validation Phase, Milestone II.

d. The revised Chapter 3, Program Management, refines command responsibilities. Its' goal is to identify AFV participating commands. Projects under program executive or program management organizations have been listed in tabular form in anticipation of a future increasing role in AFV development.

4. As a minimum review concept exploration phase goals as identified in chapter one and command responsibilities in chapter three. Provide recommended distribution changes and document changes or refinements to the point of contact listed below.

5. Projected future changes:

A. Chapter updates to reflect revised milestones.

B. Refinements to ensure adequate management of evolving technological areas such as, communications, artificial intelligence, and robotics.

C. Further changes to ensure consistency with change one.

D. Others, as recommended by AMC and TRADOC.

6. Post cover letter and this instruction change sheet prior to the ACRMP index. Due to personnel changes and rapidly evolving guidance, retain removed pages until the conclusion of the AFV Concept Exploration phase and Milestone I then destroy.

6. Point of contact is Major Robert D. Buckstad, Av 927-1465/66 or (804) 878-xxxx.

PRELIMINARY

ARMORED FAMILY OF VEHICLES

(AFV)

AUTOMATION AND COMMUNICATION RESOURCE MANAGEMENT PLAN

(ACRMP)

VOLUME XV

FOR

AUTOMATION AND COMMUNICATION SYSTEM

DEVELOPMENT

1 SEPTEMBER 1987

AFV TASK FORCE
DAMO AFV-M

FT. EUSTIS, VA
23604-5597

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EXECUTIVE SUMMARY
ARMORED FAMILY OF VEHICLES (AFV)
PRELIMINARY AUTOMATION AND COMMUNICATIONS
RESOURCE MANAGEMENT PLAN (ACRMP)
VOLUME XV

This Automation and Communications Resource Management Plan (ACRMP), Volume XV identifies organizational relationships and responsibilities required for the requirements definition, acquisition, test and evaluation, deployment, and post deployment support of the communication and computer resources for the Armored Family of Vehicle (AFV). It also specifies development, acquisition, and maintenance concepts and policies pertaining to computer resources to be used in the AFV. The ACRMP provides for the management of the integration of a large number of hardware and software component subsystems into the AFV. Key to this approach are coordinated resource management techniques, standard and common hardware and software components, low to medium risk components, and specialized development and maintenance environments whose primary purpose is to accomplish development and integration of automation and communication components for the AFV.

The challenge of managing computer resources lies in the wide variety of computer related systems to be fielded, semantic or terminology gaps, and the proliferation of automation in general throughout the Army and the Department of Defense. Tactically, a typical AFV Subsystem may have multiple automated on-board systems such as fire and weapon controls, internal and external communications, and diagnostics. It will also have multiple external interfaces to automated systems such as fire support, air defense, and command and control. Both internal functions and

external interfaces will share common hardware and software components such as displays, data entry devices, busses, and operating systems. This presents a significant technical management challenge as the development of mission specific systems typically have not been on common hardware or software. Portability between potential hardware configurations is a non-trivial task. Priorities and interfaces eventually must be defined to the byte level and eventually the bit level.

The AFV ACRMP addresses system engineering, requirements validation, design constraints, risk management, system support, configuration management, human factors, test management, software quality management, data and document management, logistics support, personnel, embedded and external training, compatibility and interoperability, independent validation, security, funding and organization roles, responsibilities, and relationships. Comprehensive combat and materiel development technical management is an absolute necessity. The ACRMP is formatted in seven Chapters and appendices to support AFV objectives. A brief overview of the contents of each Chapter is provided here:

a. Chapter 1 - General. Chapter one describes general guidance and serves as an introduction to AFV automational communication resource development. It outlines the purpose, scope, and background of AFV. It also includes an overview of the Automation and Communications Resource Working Group (ACRWG) that will support the preparation and maintenance of the AFV ACRMP. A summary of overall AFV system requirements are included and will be updated in planned revisions of the ACRMP.

b. Chapter 2 - Requirements Definition and Analysis. The Requirements Definition and Analysis Chapter summarizes the AFV

requirement for automation and communications resources based on the Brigade and higher Command, Control, Communications & Intelligence (C3I), Battalion and Below C3I and the Vehicle Control and Operating system, and the responsibilities and methodologies for accomplishing requirements definition and validation.

c. Chapter 3 - Program Management. The Program Management Chapter identifies the organizations and their responsibilities in relation to AFV computer resources development, and describes the management philosophy that will be used throughout the life cycle of the AFV program.

d. Chapter 4 - Acquisition Management. The Acquisition Management Chapter identifies the key resource aspects of the acquisition plan for the system and describes the acquisition strategy that will be followed for procuring the computer resources to include the development of the Life Cycle Software Engineering Center (LCSEC). Its purpose is to supplement the AFV Integrated Logistic Support Plan (ILSP).

e. Chapter 5 - Development Management. The Development Management Chapter describes the technical engineering approach and design concepts that will be followed during the development phase, and identifies the resources, costs, and schedules associated with the development of the individual communication or computer resource item. Technical control, testing, quality assurance, configuration management, security, documentation, programmer and developer environments, and training concepts are established.

f. Chapter 6 - Test and Evaluation. The Test and Evaluation Chapter identifies the testing requirements, responsibility concepts, schedule, and resources needed to test the automation and communication resource items. Its purpose is to supplement the AFV Test and Evaluation Master Plan (TEMP).

g. Chapter 7 - Plan for Support. The Plan for Support Chapter identifies resources needed to support the operation, maintenance, and configuration control of the computer resource items.

h. Appendices:

Appendix A - Acronyms and Abbreviations. This appendix is provided for clarity. Generally, acronyms are defined before their use in each chapter to ease readibility.

Appendix B - AFV Vehicle System Summary.

Appendix C - Charter for the AFV Automation and Communications Resources Working Group (ACRWG). The primary purpose of the ACRWG is to:

o Assist the Director, AFV Task Force (AFVTF) in initiating early tasks and activities that are prerequisites to development and test functions (such as configuration management level testing etc.).

o To monitor the computer resources of the AFV throughout the life cycle of the AFV project.

o To ensure that the system requires minimum computer resources, and yields maximum performance reliability, availability, maintainability, and safety to satisfy

the common needs of the operational user, and the life cycle supporter.

- o To maintain and update the ACRMP for the AFV.
- o To assist in ensuring that the ACRMP is in compliance with all current pertinent policy, procedures, plans, and standards established for automation and communication resources.

Appendix D - AFV Task Force Technology Points of Contact.

Appendix E - AFV Requirement and Planning Documents.

Appendix F - Management Checklist(s). Checklists included are materiel development milestones, system design review, specification review, design review, and Milestone I/II.

Appendix G - AFV Integrated C3. Presents AFV skeleton requirements for integrated C3.

Appendix H - Activities for Life Cycle Software Engineering Center(s) (LCSEC) Support. Describes actions to ensure automation supportability.

Appendix I - Software Development Reviews. Provides a list of software development reviews

Appendix J - AFV Automation and Communication Milestones. Provides milestones related to development of automation and communciation resources.

Appendix K thru Y are reserved for future use.

Appendix Z - References.

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CHAPTER 1 - GENERAL

1.1 INTRODUCTION - This preliminary Automation and Communication Resource Management Plan (ACRMP) identifies organizational relationships, policies, and responsibilities related to the requirements definition, development, acquisition, test and evaluation, deployment, maintenance and post deployment support of the automation and communication resources for the Armored Family of Vehicles (AFV). Automation and communication resources encompass computer equipment and peripherals, specification, programs, data, networks, associated documentation, governmental contractual services, personnel, communication equipment, and supplies. The ACRMP is formatted into seven chapters in support of DARCOM-R-70-16, Management of Computer Resources and Battlefield Automated Systems and DOD Directive 5000.29, Management of Computer Resources in Major Defense Systems.

1.2 PURPOSE - The Armored Family of Vehicles ACRMP is provided to ensure that the AFV automation and communication resource requirements are defined and planned for, developed, tested, acquired, fielded, and supported in a cost effective and timely manner. It is intended to complement the AFV Integrated Logistics Support, Test and Evaluation Master, Manprint and Training Plans. This document is intended to identify important acquisition and life cycle planning requirements and to establish specific guidelines to ensure that those requirements are adequately considered in the military development and acquisition planning process. The preliminary ACRMP will transition to its final form at the conclusion of the Demonstration Validation Phase, Milestone II, and continue to receive periodic updates throughout the AFV cycle.

1.3 BACKGROUND - The United States Army has initiated a new program to meet Army ground combat requirements of the future. The AFV is intended

to correct major deficiencies identified in the Battlefield Development Plan (BDP) and will provide a modern replacement for the current Armored Fleet. The AFV is planned to provide enhanced combat capability, battlefield synchronization, improved fightability, a common training base, higher readiness, lower operational and support costs (O&S), require fewer personnel, and provide improved survivability for the soldier. AFV will pursue maximum commonality and modularity in all subsystems. By pursuing an aggressive acquisition, mature technologies, and development schedules, the AFV can more cost effectively bring the necessary capabilities, standards of reliability, and mission effectiveness into the Army's armored fleet by the late 1990's.

1.3.1 History - The AFV is a direct outgrowth of the 1984 Special Study Group Armor (SSGA) Study in which then LTG Vuono established a tasking to investigate the ancillary effects of its efforts on the future family of vehicles. In the SSGA report, the quantitative and qualitative superiority of threat forces were enumerated along with the need to improve the U.S. capabilities to get ahead and stay ahead of this threat. As a result, the first AFV umbrella Operational and Organizational (O&O) plan was initiated in January 1985. The charter for the Armored Family of Vehicles Task Force (AFVTF) was approved on 6 October 1985 and became fully operational in June 1986. The office of the Secretary of Defense approved the Justification for Major System New start (JMSNS) in August 86 and the O&O Plan was approved in June 87. As one of only five new start systems approved, the AFV concept is clearly a high priority program, impacting the total Army (to include active, National Guard, and Reserve components). Virtually all Training and Doctrine Command (TRADOC) proponents and Army Materiel Command (AMC) major subordinate commands will be affected.

1.3.2 Funding - Funding to initiate AFV development was included in the FY88 and FY89 Budget Submission and the FY88-92 Program Objective Memorandum (POM). Throughout the Concept Exploration Phase, FY86 through the 4th QTR 89, the AFV Task Force will continue to participate and closely monitor the Mission Area Material Plan (MAMP), Long Range Research Development Acquisition Plan (LRRDAP) and POM processes to assure AFV is adequately funded and duplication is reduced or eliminated and priorities are focused.

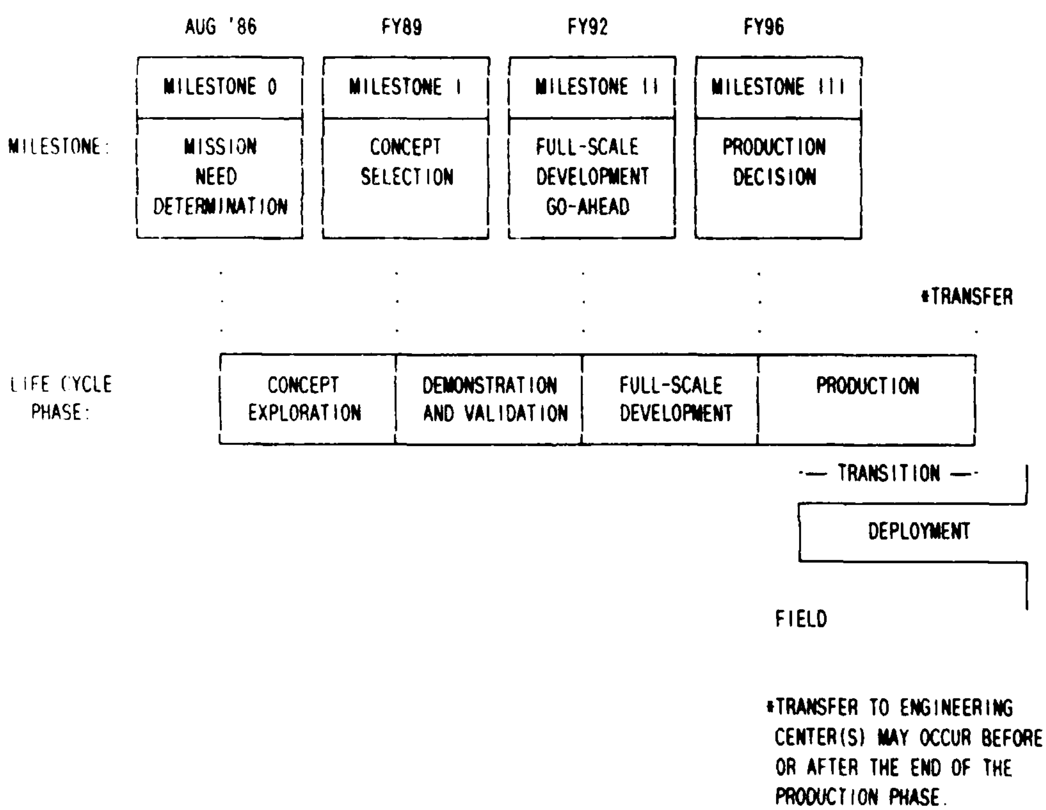

Figure 1-1. AFV Milestones

1.4 PROGRAM SUMMARY

1.4.1 Acquisition Guidance - The AFV Charter, 6 October 1985, included the edict to have hardware on the ground by FY95. This guidance was revised by the August 1987 RRC and the AFV Task Force Charter. Hardware fielding is planned for FY98.

1.4.2 Concept Exploration Phase (FY88-89) - During the Concept Exploration phase initial planning should be directed toward refining proposed solutions or developing alternative concepts to satisfy a required operational capability. Computer and communication resources lifecycle planning during this phase will ensure that development and support of automation and communication resources are adequately considered.

1.4.2.1 Engineering Studies, Analysis and Plans - Alternative concepts will normally be identified and subjected to tradeoff and optimization studies to define a system that meets mission requirements in the most effective manner. The results of these studies form the basis for the computer and communication resource areas of the System Segment Specification. The following types of studies will be performed as applicable.

a. Requirements Refinement. Analyze the system requirements including constraints, to identify the factors that drive requirements for automation and communication resources. These factors may include system interfaces, interoperability, communication functions, personnel functions, the anticipated level and urgency of change, and requirements for reliability and responsive support. Document user requirements in the AFV O&O or ROC as applicable.

b. Operational Concept Analysis. Analyze the operational concept to determine the role of computer resources. Pay particular attention to requirements for mission preparation, operator interface, control functions, and mission analysis.

c. Tradeoff and Optimization Studies. Determine the effects of system constraints, such as the operations concept, the support concept, performance requirements, logistics, availability and maturity of technology, and limitations on cost, schedule, and resources. Study alternative resource approaches for meeting operational, interoperability, and support requirements; system requirements for reliability and maintainability; alternative approaches to satisfy requirements for system security; and the suitability of standard computer languages, instruction set architectures, and interfaces.

d. Feasibility Studies. For each candidate approach, conduct feasibility studies to estimate cost and schedule. Feasibility studies may require the experimental development of resources. In these cases, the software development lifecycle will be tailored to accommodate program goals and constraints.

e. Risk Analysis. For each alternative concept, risk evaluation will be conducted. These risk assessments will be incoporated in the system-level risk management plan or in the ACRMP.

f. Test Planning. Start initial test planning for computer resources during this phase and document these plans in the system Test and Evaluation Master Plan (TEMP). Interface and interoperability testing will be included if the system needs to operate with other systems.

1.4.2.2 Automation and Communication Resources Working Group (ACRWG) - During this Concept Exploration phase the CRWG will:

a. Develop and refine this ACRMP.

b. Develop alternatives for computer resources lifecycle support. Evaluate and explore overall support concepts, develop a preliminary allocation of software support responsibility, study the potential for organic and contractor support, and identify candidate organizations for performing software support. Document conclusions in the ACRMP.

c. Identify any unique requirements for software quality. Identify and prioritize the required software quality factors such as interoperability, portability, flexibility, usability, reusability, maintainability, integrity, reliability, correctness, testability, and efficiency. Define the appropriate scope of Independent Verification and Validation (IV&V) and develop a recommended approach.

d. Evaluate the use of standard equipment, high order languages, instruction set architectures, and interfaces. Evaluate the need for development of software tools and recommend an approach.

1.4.2.3 Automation and Communication Resource Planning - At the end of Concept Exploration the following products will be delivered to support a milestone I decision.

a. ACRMP. Chapter one, General (Introduction) will be completed. Chapter two, Requirements will be updated to reflect the AFV Required Operational Capabilities (ROC). Chapter three, Program Management and Chapter five, Development Management will be refined. Chapter four, Acquisition Management and Chapter six, Test and Evaluation will be updated and reflect the ILSP and TEMP. The ACRWG charter will be staffed and a copy will be attached as an appendix to the ACRMP. Draft appendices will include the Risk Management Plan, Vehicle Control and Operation System (VCOS) and Battalion and Below Command and Control (B2C2) Management Development Plans.

b. Concepts and Specifications. The preliminary System Operational Concept and System Segment Specification will be delivered. Drafts of the interface and hardware/software specifications will also be produced.

c. Plans. In addition to the ACRMP additional technical management plans are required. Automation and communication configuration management, quality evaluation and development support plans will be produced in draft.

d. Reviews. The ACRWG will meet periodically and the System Requirement Review will be conducted prior to Milestone I.

1.4.2.4 Objectives - Objectives, when achieved, will provide the basis for the Milestone Decision in the 4th Qtr FY89 to enter the Concept Demonstration Validation Phase.

1.4.3 Demonstration Validation Phase (FY90-93) - During the Demonstration Validation Phase, the Army will validate the choice of alternatives to provide the basis for determining whether or not to proceed into Full Scale Development (FSD). Work efforts will be defined or refined to provide confidence that risks have been resolved or minimized and cost, schedule and performance requirements are met.

1.4.3.1 <u>Engineering Studies, Analysis and Plans</u> - System engineering studies are based on the concept of hierarchy of requirements starting with system-level requirements and ending with detailed engineering specifications and data. System definition will proceed by refining each level of requirements into subordinate requirements until the entire system is described. At each step, automation and communication resources are considered as an integral part of the system and are subject to tradeoff and optimization studies. System engineering studies will normally include:

a. Requirements Definition: Technical requirements definition based in operational requirements includes determining a preliminary allocation of requirements between hardware and software. Document the requirements for each software configuration item in a draft Software Requirements Specification (SRS), which will be authenticated at the Software Specification Review held (prior to or) early during the FSD Phase.

b. Interface Definition. The Automation and Communications Resource Working Group, in conjunction with the (to be formulated) Interface Control Work Group or Board will address system/subsystem interface requirements that may effect automation and communication resources. Preference will be given to military standard (MIL-STD) and Army Materiel Command specified interface standards. Interface requirements will be documented for each Configuration Item in the Interface Requirement Specification or in (or referenced) the Software/Hardware Requirements Specification.

c. Technical Tradeoff and Optimization Studies. Tradeoff and optimization studies will consider issues such as:

(1) Tradeoffs between computer software and computer hardware.

(2) Required processor architecture features such as memory size, processor speed, and input and capacity, including spare capacity

(3) Use of standard equipment, igh order languages, instruction set architectures, and interfaces.

(4) Alternate approaches for meeting system security requirements.

(5) Improved supportability versus improved performance.

(6) High versus low speed data communication.

(7) Communication system supportability.

(8) Use of existing Government resources or commercial off-the-shelf resources versus new development.

d. Feasibility Studies. Determine the feasibility of alternative allocations of system requirements to computer resources and derive data for formulating budgets and schedules.

e. Risk Analysis. One of the most important objectives of the Demonstration and Validation phase is to identify development risk, so that risk management can be applied during FSD. Identification of the major risks to the development effort. Incorporate plans to manage these risks into the system level risk management plan or in the ACRMP.

f. Software Support Studies. Conduct software support studies as needed to refine the system support concept and allocate software support requirements. These studies should also determine how software which is loaded in the operational system will be identified, through such methods as self-identification of executing software, identification plates affixed to the outside of the computer, and so forth.

g. Test Planning. Establish quantitative and demonstrable performance objectives and evaluation criteria, reflecting those of the overall system, for the computer hardware and software. Based on criticality of software-intensive system functions, determine the system/software test approach and test tools to reduce risk to an acceptable level. Update the Test and Evaluation Master Plan (TEMP) to reflect the test objectives (performance, functional, interface, interoperability, etc.) and evaluation criteria for the computer resources in the system. Include plans for Development Test and Evaluation (DT&E) and Operational Test and Evaluation (OT&E) of computer resources.

h. Development of Prototype Computer Resources. During the Demonstration and Validation phase, it will be necessary to develop prototype system models that incorporate communication and computer resources. It may also be necessary to develop prototype software to demonstrate critical algorithms, control sequences, timing, or operator interfaces. The software development cycle applies to prototype

developments, but it may be tailored if the software will not carry over into the FSD phase.

i. Independent Verification and Validation (IV&V). The ACRMP will assess the need for IV&V and recommend the appropriate level, scope, and source to the PEO or program manager. The program manager will determine the requirements for IV&V, obtain a source of IV&V, determine the access that the IV&V organization must have into the development contractor's effort, and plan for providing that access. Document IV&V decisions will be documented in the ACRMP.

j. Software Quality Evaluation. The overall software quality evaluation program for the software development lifecycle will be defined. Responsibility for evaluating computer software products and procedures may be assigned to more than one organization, including an independent organization (for example, the IV&V or operational testing organization).

k. Configuration Management. Definition of the overall approach for configuration management of computer resources will be completed during the Demonstration and Validation Phase.

1.4.3.2 Automation and Communication Resource Working Group (ACRWG) - The ACRWG selects the best hardware/software support concept which best fits the system and mission as stated in the Operational & Organizational (O&O) Plan, ROC, and System Operational Concept. The support concept will be described in sufficient detail to account for system perculiarities and existing conditions. The ACRWG will update the ACRMP for the AFV Task Force Director or PEO approval.

1.4.3.3 Automation and Communication Resource Planning

a. ACRMP. Prior to the conclusion of the Demonstration and Validation Phase the ACRMP will be signed by the AFV program office and coordinated with TRADOC and AMC. Preparation of the final version will occur as soon as possible during this phase to accommodate resource allocation and FSD planning. All ACRMP chapters with the exception of Deployment and Post Deployment Support will be finalized.

b. Concepts, Specifications, and Plans. Products produced during Concept Exploration will be updated and validated. As a minimum the total

top-level System Design Review will be held. It is envisioned that products associated with the preliminary or critical design review (MIL-STD-2167) will or may be required in draft or final form.

c. Reviews. A System Design Review (SDR) will be held early (see MIL-STD- 1521) to formally assess the allocated system requirements before proceeding into preliminary design of the computer hardware and software configuration items. The SDR will authenticate the System/Segment Specification. Additional reviews are planned to support system development configurations.

d. Contracting. The AFV Task Force or PEO will solicit request for proposal (RFP) inputs from using and supporting organizations. The identification of automation and communication in the work breakdown structure (WBS) will be in sufficient detail to ensure adequate visibility and management control and to outline the program to potential contractors. Requirements concerning supportability, computer resource technology, configuration item allocation (between mission and system software), access for the IV&V organization, and software development methodology must be reflected in statement of work tasks or compliance documents.

1.4.3.4 <u>Demonstration Validation Phase Objectives</u> - At the conclusion of Demonstration Validation, sufficient information, data, and management plans must be collected and documented for a Milestone II decision.

1.4.4 <u>Full Scale Development (FSD) Phase</u> - During the FSD phase, design, fabricate, test, and evaluations of the hardware, software, facilities, personnel subsystems, training, and the principal items necessary for support will be conducted. Products will closely approximate the production item and support equipment and will meet the stated performance requirements.

1.4.4.1 <u>FSD System Development</u>

a. Hardware/Software Development. Software and hardware to include communication system development entails the six phases of the traditional development cycle. Although they are described as sequential phases, a top-down development approach may cause them to occur concurrently, with

different portions of a configuration item being developed in parallel and each portion proceeding through the six phases sequentially.

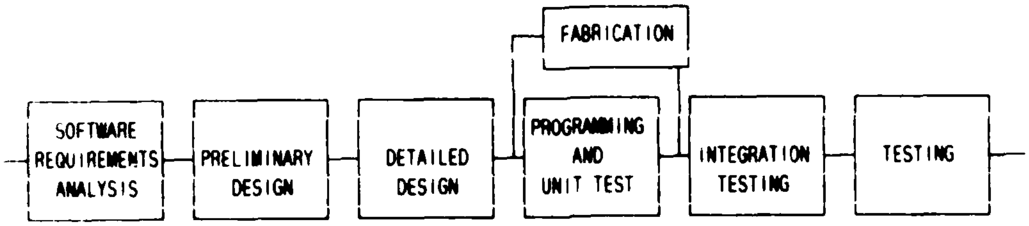

Figure 1-2. Hardware/Software Development Cycle

b. System Integration and Testing. Successively integrate CSCIs and HWCIs and test to validate that the complete system is properly integrated and meets system requirements. Participation of the using and supporting organizations in system testing is recommended.

c. Development Test and Evaluation (DT&E). The program office will ensure that software expertise is available during DT&E to provide a valid technical assessment of the system.

d. Operational Test and Evaluation (OT&E). The program office and the supporting organization will ensure that software expertise is available during OT&E to support the evaluation of the operational effectiveness and suitability of the computer resources in the system.

e. Independent Verification and Validation (IV&V). Provisions for IV&V (organizational agreements or contracts) must be in place early in the FSD phase. Army organizations participating in IV&V will be identified by the same date. The implementing command will: (1) define and control the interface between the IV&V agency and the development contractor, (2) provide the IV&V agency with copies of appropriate development specifications, design documents, listings, and technical data, and (3) resolve all discrepancies found during IV&V.

f. Software Quality Evaluation. The program office will evaluate software quality throughout this phase for all software development activities and products.

g. Configuration Management. The program office will continue to apply formal configuration management (change control) to automation and communication resources throughout this phase.

h. Software Support. The program office will plan to acquire the dedicated hardware and software necessary to support the system under the support concept described in this ACRMP. The software support organizations will participate in development and testing activities at the contractor's facility and at the system integration and test facility.

1.4.4.2 Automation and Communication Resource Working Group (ACRWG)

a. The ACRWG will update the ACRMP as necessary and will monitor program compliance with the contents of the ACRMP.

b. When software support responsibilities are split between commands, the ACRWG will categorize each Computer [Communication] System Configuration Item (CSCI) as either a mission or system CSCI. This will be done after authentication of the allocated baseline when the system's CSCIs have been defined. The ACRWG will then recommend assignment of support responsibilities for each CSCI in accordance with the software support concept. If agreement is not reached on the assignment of software support responsibilities after thorough technical review by the ACRWG or developing contractor, the operating command conviction will prevail.

c. The ACRWG will recommend the grouping of Computer System Configuration Items into Computer Segments.

d. The ACRWG will document the above recommendations in the ACRMP.

1.4.4.3 Automation and Communication Resource Planning

a. ACRMP. The ACRMP will be updated to reflect the results of life-cycle planning activities and to reflect relevant program changes. It will be completed, coordinated, and signed by the end of this phase.

b. Development Reviews. The implementating agencies will normally conduct the following software development reviews during this phase: Software Specification Review (SSR), Preliminary Design Review (PDR), Critical Design Review (CDR), Test Readiness Review (TRR), Function Configuration Audit (FCA), Physical Configuration Audit (PCA), and Formal Qualification Review (FQR).

c. Production Approval. Prior to approving computer resources for production, the functional and allocated baselines will be current, the

Formal Qualification Review (FQR) will be completed, the product baseline will be established, all three baselines will be under proper configuration control in accordance with MIL-STD-2167 and the support concept will be established and coordinated.

1.4.4.4 FSD Objective - To be determined.

1.4.5 Production Phase - The Production phase begins with the production decision and ends when the last system has been delivered and accepted. The majority of planning will be complete before entering this phase. Continue planning related to production and transition. Resolve all computer resources lifecycle planning issues and review the ACRMP to ensure that it adequately addresses production and deployment phase activities. The following paragraphs will be developed during subsequent revisions of the ACRMP.

1.4.5.1 Automation and Communication Resource Activities

1.4.5.2 Resource Redevelopment

1.4.5.3 Configuration Management

1.4.5.4 Transition Period

1.4.5.5 Automation and Communication Resource Working Group

1.4.5.6 Configuration Baseline

1.4.5.7 Reviews and Audits

1.4.5.8 Production Phase Objectives

1.4.6 Deployment Phase - The Deployment phase begins with fielding of the first article and terminates when the system is removed from the operational inventory. This chapter applies to the operation and support of system computer resources during the Deployment phase, with particular attention to software support. This paragraph will be developed further during subsequent ACRMP updates.

1.5 PROGRAM STRUCTURE

1.5.1 Management - The complexity and magnitude of the AFV program dictates a commensurate management structure capable of resolving the program's fundamental integration, configuration management, testing, and interface control challenges. The O&O Plan extract at Figure 1-3 serves to illustrate the complexity of the AFV program.

1.5.2 Concept Exploration Phase - During Concept Exploration Phase (FY88-89), management will continue to reside with the AFV Task Force supported by the Department of the Army (DA) Staff, AMC, and TRADOC. Contractor teams will carry through in the development of alternative approaches to the family of vehicles as described below. During the later part of concept exploration or early demonstration validation, it is envisioned that the AFVTF will evolve into a formal Program Executive Office (PEO) reporting to the Army Acquisition Executive (AAE). Award of a Systems Engineering/Technical Assistance (SETA) system integrator contract concurrent with the establishment of the PEO is planned. This contractor, in concert with the established Project Management Offices (exact number to be determined) and an appropriate AMC Major Subordinate Command(s) (MSC) will assist the PEO in carrying out his assigned responsibilities.

1.5.3 Demonstration and Validation Phase - Given a Milestone I go ahead decision to enter into this phase during the 4th Qtr FY89, selected hardware prime contractors will assume management responsibility for the design, fabrication, integration, and test of AFV prototype systems. A Milestone II Full Scale Development decision in the late FY92 will result in a similar, expanded program structure.

1.5.4 Full Scale Development - To be determined.

1.5.5 Production and Deployment - To be determined.

1.5.6 Government Agencies - Due to the nature and complexity of the AFV program, almost all of the TRADOC and AMC subordinate commands, schools, and centers will be involved in the development of the AFV. Specific responsibilities have been identified and are discussed in Chapter 3.

1.6 CONTRACTING STRATEGY

1.6.1 Concept Exploration - Given the nature of this program it is possible that multiple prime contractors may be selected to execute the Concept Exploration Phase.

1.6.2 Government Furnished Equipment (GFE) - As with most major programs, selected government developed systems will be furnished to the selected hardware prime contractors. The AFV program has a fundamental design premise to maximize component commonality and modularity. It is the intent to establish minimum essential levels of commonality prior to the Demonstration and Validation Phase. These decisions will influence contractor selection of components, out, at this time it is the intent that components will be contractor furnished items.

AFV O&O REQUIREMENTS, TOP LEVEL

COMMAND AND CONTROL SYSTEM
- SUPPORT AIRLAND BATTLE
- EN LEVEL C2 SUPPORT-BMS

INTEGRATION/INTERFACE WITH:
- ADMIN/LOGISTICS
- POSITION/NAVIGATION
- W/OTHER VEHICLES
- ACCS-SIGMA STAR POINTS INTERFACE
- FIRE CONTROL-WEAPON, IMPROVED
- ENVIRONMENT CONTROL
- BMS (VEHICLE CONTROL)
- AUTOMATED ROUTINE C2 FUNCTIONS

BUILT IN TRAINING MODULES

COMMUNICATIONS - DATA AND VOICE
- COMMUNICATIONS COMMON W/AFV

HARDWARE
- COMMON DISPLAYS (HARDWARE)
- DRIVER DISPLAY/HARDWARE, COMMON
- COMMANDER DISPLAY(S)/HARDWARE

THREAT ENVIRONMENT
- EMP PROTECTION, NEEDED
- ECM PROTECTION, NEEDED
- HPM PROTECTION, NEEDED
- ANTENNAE PROTECTION AGAINST ARTY
- AVOID UNIQUE SIGNATURE
- NBC PROTECTION/DETECTION/ALARM

PRODUCIBILITY/COMMONALITY
- MODULAR DESIGN
- COMMONALITY
- RECONFIGURABLE CAPABLE
- VETRONICS, COMMON ARCHITECTURE
- NATO INTERFACE
- AUX POWER UNIT

MAINTENANCE
- BUILT IN TEST (BIT)
- DIAGNOSTICS
- PROGNOSTICS
- GRACEFUL DEGRADATION
- AUTO LOGBOOK (LSA/LSAR)
- INTERFACE W/TMDE

OPERATION SUPPORT ENVIRONMENT
- CONTINUOUS OPERATION
- EASY INTERFACE, SIMPLIFY CREW DUTIES
- 5-95 PERCENTILE SOLDIER USE

ANTENNAE
- QUICK ERECT (SELF CONTAINED)

NAVIGATION
- POSITION/NAVIGATION GENERAL

ROBOTICS
- ROBOTICS WHEN POSSIBLE
- AUTOLOADER
- REARM W/O EXPOSING (RAPID)
- REFUEL W/O EXPOSING (RAPID)
- RESUPPLY W/O EXPOSING
- NBC SAMPLING
- AUTO COUPLING (TOW VEHICLE)
- MINE DETECTION
- MINE CLEARING

P3I POSSIBILITIES, PLAN FOR

MOBILITY
- STATIC, OPERATION
- ON THE MOVE, OPERATION
- VARIABLE CLIMATIC OPERATIONS

FIGURE 1-3

1.6.3 Demonstration and Validation Alternatives - The initial study phase of the AFV program has been carried out using two or three competitively selected teams under the Firm Fixed Price (FFP) contracts. In the interest of continuity and in view of the compressed development program, these same teams will be maintained during the balance of FY88-89. Based on the results of this phase and a go ahead decision at Milestone I, the intent is to compete the Demonstration and Validation (Dem/Val) Phase of the program. Two alternatives are currently under consideration as follows:

- o The first alternative is based on carrying only one version of the family through the Dem/Val Phase of the program. In this case a multi-scope RFP which will allow qualified firms to compete for the entire family, or for any subsystem, or set of subsystems is envisioned. In this manner, smaller firms possessing specific capabilities/strengths will be able to compete on an equal basis with larger firms having broader capabilities. Although this alternative features competition, it is limited to a paper competition resulting in one version of AFV hardware.

- o The second alternative is to follow the same process described above but to select two sets of contractors producing competing hardware. In either case it is planned to execute this phase of the program under Cost Plus Incentive Fee (CPIF) contracts. Incentive awards will be principally base on technical and support considerations

1.6.4 Full Scale Development - To be determined.

1.6.5 Production/Deployment (P/D) - For the P/D phase of the program, it is planned to award 2 successive single year Firm Fixed Price Incentive (FFPI) contracts followed in the third year by the first of a series of 5 year multi-year contracts. Incentives will be based on design to cost and supportability goal attainment. In addition, the AFV fleet will be covered by warranty provisions. This paragraph will be refined in future updating of the ACRMP.

1.7 AFV DEVELOPMENT SYSTEM METHODOLOGY

1.7.1 Software Development System Methodology - The complexity of functions and variations in the hardware configurations associated with the AFV the development and support of mission critical computer components will require a software development and integration technical and managerial system that embodies all of the characteristics demanded. The system must produce complete, tested, and integrated software components to be fielded concurrent with hardware. The development system therefore must be able to manage the production and integration of software components produced from a variety of sources. Software development must be able to specify standards and interfaces from the top down under an accelerated program. The system must be able to rapidly test and evaluate software module performance. The system must produce software that is efficient in its use of hardware resources. The use of standard, common, and reusable software components will be maximized. The system must be able to provide software maintenance and support over the life cycle of the AFV and therefore must be flexible and it must be able to produce revised software configurations efficiently. In all Army Mission Critical Computer Resources (MCCRs) the development of hardware, accompanying software, and documentation proceed through the system life cycle concurrently. The system will not be approved for advancement to the next acquisition phase until hardware, software, and documentation have satisfied all requirements of the earlier phase.

1.7.2 Hardware Development System Methodology - AFV hardware components will be modular, will interface to a standard bus, will be designed to continue to provide the most critical functions when operating at less than full capability, will provide excess capacity to accomodate preplanned product improvements and will contain self test diagnostics and prognostics.

1.7.3 Communication System Development Methodology - AFV requires voice and data communication subsystems to support vehicle command and control functions. Army command and control subordinate communication subsystems are planned to be integrated into AFV subsystems.

1.8 SCOPE - This document focuses on the planning, acquisition, development, testing, training, and support for the life cycle of the Armored Family of Vehicles (AFV) communication and computer resources.

1.8.1 Organization of the ACRMP - In order to address the complexity of computer resources management as described, this ACRMP has seven Chapters: general, requirements analysis, program management, acquisition management, development management, test and evaluation, and a plan for support. Refer to the Executive Summary at the beginning of this ACRMP for a by chapter summary.

1.8.2 Computer Resource Acquisition - Computer resources must be considered during each phase of the acquisition cycle and at each milestone. Development of computer resources necessitate clear specification of requirements, appropriate allocation of functions between hardware and software, and a division of large systems into manageable subsystems. The software milestones and attainment criteria emphasize those actions that must be satisfactorily completed prior to progressing from one system acquisition phase to the next.

1.8.3 Communication Resource Acquisition - Communciation resources will also be considered during each phase of the acquisition cycle. In particular, communications supporting other AFV functions such as data transfer and computer resources must be considered along with the supported functions.

1.9 SYSTEM REQUIREMENTS

1.9.1 System Performance - AFV requirements for automation and resources are analyzed in Chapter 2 of the ACRMP. A summary of these requirements is shown in Figure 1-4. The requirements include external interfaces as well as internal components. In addition system processor(s) architecture shall exhibit graceful degradation. It shall strive for automatic reconfiguration of remaining processing and bus resources with the loss of any unit. The goal is to achieve maximum performance and integration at each mission work or fighting station within the vehicle.

1.9.2 Software Classification - It is planned that all software programs will be unclassified. Any classified information processing will be minimized and accomplished using a classified data base separate from the unclassified data base. This data base will be removable with provisions to erase the memory or physically destroy the unit on vehicle destruction. Tactical critical software will have highest priority and will be partitioned from non-tactical critical software based on operational efficiency.

1.9.3 Programming Languages - For each of general category of processing (signal, general data) only one programming language will be used. MIL-STD-1815A Ada is required for use on all general data processing, fire control, training, ground support equipment, and signal processor control systems. It is required that Ada be used wherever practical in all other systems (i.e., expert systems, array, and vector processors).

1.9.4 Software Design - A modular software design will be employed to facilitate compilation of individual modules, testing, and system configuration. The AFV system software will be developed as an integrated software package. The Utility software will be a subset of the vehicle

FV Requirement Summary

- INTERCOM WITH NOISE SUPPRESSION
- AUXILIARY POWER
- EXTERNAL LOCAL AREA NETWORK
- COMMON MISSION WORK STATIONS (Driver, Gunner, FV Commander, Staff)
- POSITION NAVIGATION (Position, Altitude, Azimuth, Digital support)
- ARMY COMMAND AND CONTROL SYSTEM (ACCS) INTERFACE
- VEHICLE DEFENSE SYSTEM
- DATA DISTRIBUTION (EPUU, SINCGARS)
- AREA COMMUNICATIONS (Mobile Telephone)
- COMMUNICATIONS CONTROL w/CEOI
- COMBAT NET RADIO (Short Range, Long Range)
- BATTALION AND BELOW COMMAND AND CONTROL (B2C2)
- FIRE AND WEAPON CONTROL
- NBC (Detection, Protection)
- FIRE EXTINGUISHER/SUPPRESSOR SYSTEM
- ENVIRONMENTAL CONTROL/LIFE SUPPORT SYSTEM
- TRAINING MODULE (Operations, Maintenance, Mission, Shoot)
- MISSION EQUIPMENT OPERATIONAL SUPPORT MODULE
- COMBAT SERVICE SUPPORT STATUS MODULE
- COMMON VEHICLE CONTROL/OPERATION MODULE
- VOICE RECOGNITION SYSTEM (P3I)
- EXTERNAL TMDE INTERFACE
- INTERNAL DIAGNOSTICS/PROGNOSTICS
- BUILT IN TEST (BIT)
- EVOLUTIONARY COMBAT IDENTIFICATION SYSTEM (CIS)

Figure 1-4

operational modules. Embedded training modules are planned to be a subset of the on-board application software.

1.9.5 Hardware Design - It is envisioned that hardware design will be modular with standard power, data, and mechanical interfaces. Of particular importance is the standardization of data entry and display hardware at the FV stations. Hardware components will be designed for ease of insertion and removal. Unless explicitly noted otherwise the term hardware refers to automation and communication equipment.

1.10 AUTHORIZATION - The preliminary ACRMP was prepared under the guidance provided by the Director, AFV Task Force (DAMO-AFV). It is the primary document used for management of computer and communication resource development for the Armored Family.

1.11 ADMINISTRATION - The ACRMP will undergo evolutionary changes as the program's plans develop and change through its life cycle. It will be updated periodically before each milestone. Appropriate organizational elements of the Army will review and provide recommendations. The Director, AFVTF has overall responsibility for the ACRMP. The Deputy Director, Materiel Development, AFVTF chairs the ACRWG which will maintain the ACRMP.

1.12 ACRMP RECOMMENDED CHANGES - Concerns, comments, and recommended changes are highly encouraged and should be submitted on DA Form 2028, Recommended Changes to Publications and Blank Forms or equivalent, directly to Director, AFV Task Force, ATTN: DAMO-AFV-M/Major Buckstad, Fort Eustis, VA 23604-5597. Telephone AUTOVON 927-1465/6/7 or (804) 878-1465 to discuss AFV automation and communication matters.

1 13 SUMMARY, GENERAL - Chapter 1 of the ACRMP describes the origins and the direction of the AFV program. Figure 1-5 summarizes the objective for AFV automation and communication system development.

PHASE	OBJECTIVES FOR AUTOMATION AND COMMUNICATION RESOURCE DEVELOPMENT
Concept Exploration	Define operational concept and requirements. Conduct Analysis - Validate Requirements. Top Level Specifications in place. Draft management plans produced.
MSI	Approval Concept with or without changes.
Demonstration and Validation	Conduct analysis and design. Confirm concept selection. Determine concept feasibility. Refine plans and specification.
MS II	Development approval, required changes identified.
Full Scale Development	Automation and Communication Life Cycle Development. Finalize plans and specifications.
MSIII	Production and/or fielding approval, required changes identified.
Production	Life cycle development refinement. Refine plans and specifications. Finalize fielding plans.
Deployment	Field system. Life Cycle Support.

Figure 1-5. AFV Automation and Communication Resource Development Goals

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CHAPTER 2 - REQUIREMENTS ANALYSIS

2.1 INTRODUCTION

Analysis has determined that computer resource requirements are divided into three distinct parts, Brigade and higher, Battalion and below C3I functions (addressed as B2C2, Batalion and Below Command and Control), and the Vehicle Control and Operating System (VCOS) which is generally composed of all internal functions. Brigade and higher tactical automation and communication requirements are handled by the Army Command and Control System (ACCS). The ACCS architecture will not be redefined in this document. It is assumed the reader is famililar with the ACCS architecture. ACCS, B2C2, and VCOS operational compatability is essential. C3I at Battalion and below levels and VCOS is briefly described in this chapter to provide the basis for the AFV Required Operational Capabilities (ROC). Battalion C3I supports the commanders and staff in fighting the force whereas VCOS assists the soldier in fighting the vehicle. B2C2 and VCOS concepts originated from the Battlefield Management System. However, there is a logical separation of C3I and vehicle control functions to allow for parallel development. An individual Fighting Vehicle (FV) may contain a range of external C3I interfaces depending on the use of the FV at battalion, company, or platoon level. All FV's will contain a basic suite of internal automated functions augmented according to vehicle type with specialized functions. Figure 2-1 summarizes the external and internal automation and communication components for the AFV. This chapter will be modified as required when the Combined Arms Center (CAC) defines and finalizes the B2C2 and VCOS system definitions.

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AFV C4 Components

VEHICLE CONTROL & OPERATING SYSTEM (VCOS)

INTEGRATED COMMAND, CONTROL, COMMO, INTEL (C3I)
- ARMY COMMAND CONTROL SYSTEMS (ACCS)
- BATTALION & BELOW COMMAND & CONTROL (B2C2) SYSTEM

AFV CANDIDATE MATERIEL SOLUTION

Figure 2-1

2.2 BRIGADE AND HIGHER C3I ELEMENTS

The Army Command and Control Subordinate Subsystems (ACCSS) comprise the Brigade and above architecture. These systems include:

COMMAND AND CONTROL (C2) Systems

- o Advanced Field Artillery Tactical Data System (AFATDS)
- o All Source Analysis System (ASAS)
- o Combat Service Support Control System (CSSCS)
- o Forward Area Air Defense Command, Control, and Intelligence (FAADC2I)
- o Maneuver Control System (MCS)

Communications

- o Enhanced Position Location Reporting System (EPLRS)
- o Joint Tactical Information Data System (JTIDS)
- o Single Channel Ground Airborne Radio System (SINCGARS)
- o Mobile Subscriber Equipment (MSE)

Each of the C2 systems serves as the force level control system for the respective functional area. Each of the C2 systems, except MCS (and possibly CSSCS), plan for integrated C2 below Battalion level within their mission area. Air Land Battle (ALB) requires Army Command and Control Subordinate Systems (ACCSS) to interface with the B2C2 system.

2.3 BATTALION INTEGRATED C3I ELEMENTS

ALB requires an integrated B2C2 system capable of capturing command information within the Battalion Commanders area of influence. Analysis of Battalion C3I multiple mission area automation and communication resource requirements indicates a need for automated support in tactical command and control (C2), tactical C2 feedback, functional command, control, and communications (C3), and functional C3 information feedback. These information elements are displayed at Figure 2-2 along with their operational location at Figure 2-3. Figure 2-2 presents a summary B2C2 definition. The overiding objective of this automated support is to save the chain of command time by reducing manual workloads and improve information reliability and timeliness. The B2C2 is expected to be a software system supported by the Vehicle Control and Operating System (VCOS) hardware. CECOM is the planned B2C2 software developer. CAC is the combat developer. B2C2 must be tailorable to the commander's needs. Therefore B2C2 functionality must be capable of support of the myriad of C2 functions within the battalion force. Figure 2-4 graphically portrays the varying degree of capabilities the B2C2 system must capture at various positions within the chain of command. This figure simply indicates that the FV commander's B2C2 requirements are less that the battalion commander's requirements. For example: the unit commander has an intelligence module whereas the FV commander may only have tactical C2 modules. B2C2 modules follow.

2.3.1 Tactical Command and Control

Tactical command and control components and procedures of B2C2 support the direction, movement, and employment of the fighting force on the battlefield.

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Battalion and Below Command and Control (B2C2)

Item No.	Type Information	Content	Battalion Principal	Staff Action/ Interest	Subordinates on Net	Type Net	Dedicated Battalion & Below Reqt	Battalion & Below Interface	ACCS Feeder Support
1.0	Tactical C2	Operations Order	CDR	ALL	CO CDR *	Voice	YES	n/a	MCS/ALL
2.0		Frago	CDR	S3	CO CDR *	Voice	YES	PLT	MCS
3.0		Immediate Info	CDR	S3	CO CDR *	Voice	YES	PLT	MCS
4.0		Immediate Guidance	CDR	S3	CO CDR *	Voice	YES	n/a	MCS
5.0		Battle Graphics	S3	S2/S4/FSE	CO CDR *	Data	YES	PLT	MCS/ALL
6.0	Tactical	Operational Status	CDR/S3	S1/S4	CO CDR *	Voice/Data	YES	PLT	MCS/ALL
7.0	Information & Feedback	Battlefield Locations	CDR	S3/S4/S2/FSE & ATTACH	CO/PLT/FIST	Data	YES	PLT/ATTACH	MCS/ALL
8.0		Mission Capability	CDR	S3	CO CDR *	Data/Voice	NO	FIST/CO/PLT	MCS/ALL
9.0	Functional	FS Req/Response	FSE	S3/S2	FIST	Data/Voice	NO	FIST/CO/PLT	AFATDS
10.0	C3I	ADA Warning	ADA OFF	S3/FSE	ADA UNIT/CO	Data/Voice	NO	All Elements	FAADC2I
11.0		Immed CSS	S1/S4	S3	CO/PLT/SQD	Data/Voice	NO	All Elements	CSSC2
2.0		NBC/DE Attack	CDR/S3	S2	CO CDR *	Data/Voice	NO	All Elements	MCS/ASAS
13.0		ADA Msn Results	ADA OFF	S3/S2	ADA/CO	Data	NO	--	FAADC2I
14.0		FS Results	FSE	S3/S2	FIST	Data	NO	FIST/CO/PLT	AFATDS
15.0	Functional	Routine Log	S4	S3	CO/PLT/SQD	Data	NO	All Elements	CSSC2/ALL
16.0	Information	Log Status	S4	S3	CO/PLT/SQD	Data	NO	All Elements	CSSC2/ALL
17.0		Routine Personnel	S1	S3/S4	CO/PLT/SQD	Data	NO	All Elements	CSSC2
18.0		Personnel Status	S1	S3/S4	CO/PLT/SQD	Data	NO	All Elements	CSSC2
19.0		ADA Status	ADA OFF	S3	ADA/CO	Data	NO	--	FAADC2I
20.0		Maint Posture	S4	S3	CO/PLT/SQD	Data	NO	All Elements	CSSC2
21.0		NBC/DE Posture	S3	S2	CO CDR	Data/Voice	NO	All Elements	MCS/ASAS
22.0	RSTA and	SITREP	S2	S3	CO/PLT/SQD	Data	YES	All Elements	ASAS
23.0	Intelligence	Shell Report	S3	S2/FSE	CO/PLT/SQD	Data	YES	All Elements	ASAS
24.0		Threat Graphics	S2	S3/FSE	CO/PLT	Data	YES	---	ASAS
25.0		Target Info	FSE	S2/S3	CO CDR *	Data/Voice	NO	SQD/ATTACH	ASAS
26.0		Order of Battle	S2	S3/FSE	CO CDR *	Data	NO	---	ASAS
100.0	Vehicle	Vehicle Opns Sys	XO	S3/BMO/ALL	NA	Internal	YES	All	B2C2**

Figure 2-2

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B2C2 Requirement Distribution

Item No.	Type Information	Content	Bn Cdr & Staff	Co Cdr	XO, 1SG	Plt Ldr	Plt Sgt	Sec/ Sqd Ldr	Fighting Vehicle (FV) Cdr	NOTES/COMMENTS (Reference the item number, on left)
1.0	Tact C2	Operations Order	E	E	R	R	NA	NA	NA	1.0) 5 para's, voice reqd, data dist asst desired.
										1.1) Brigade interface.
										1.2) Company slice.
										1.3) Digital required, voice assumed, network.
										1.6) Attached & in area digit reqd, voice assumed.
										1.7) Digital required, voice assumed.
										1.8) Communicate with Friendly Aircraft.
										1.9) Designate who shoots, Candidate P3I.
2.0		Frago	E	E	R	R	NA	NA	NA	2.0) Voice Required, Dta Dist highly desired
										2.1) Voice Required, Dta Dist highly desired
3.0		Immediate Info	E	E	R	R	NA	NA	NA	3.0) Plain text.
4.0		Immediate Guidance	E	E	R	R	NA	NA	NA	4.0) Plain text.
5.0		Battle Graphics	E	E	R	R	NA	NA	NA	5.0) Blue Force, terrain desired
6.0		Operational Status	E	E	R	R	NA	NA	NA	6.0) Unit Rollup of essential information.
7.0		Battlefield Locations	E	E	R	R	NA	NA	NA	7.0) Friendly locations.
										7.1) Six digit grid, Azmuith & Alt for Shooters.
										7.2) Unit Rollup.
										7.3) Problem Areas.
										7.4) Attached or operating in Bn Area of Opns.
8.0		Mission Capability	E	E	R	R	NA	NA	NA	8.0) Mission ready or Not ready.
										8.1) Ready to fight.
										8.2) Unable to fight.
9.0		FS Req/Response	E	E	R	E	E	D	NA	9.0) Indirect Fire, Naval or Air Support.
										9.1) Call for fire.
										9.2) Rounds on or not on the way.
										9.3) FS plan distribution support.
										9.4) Use mortars.
										9.5) Rounds on or not on the way.
10.0		ADA Warning	E	E	D	E	D	E	E	10.0) Inbound or outbound aircraft in area.
										10.1) Prepare to Threat attack.
										10.2) Don't shoot.
11.0		Immed CSS	E	E	D	E	D	E	E	11.0) Must have CSS, mission required.
12.0		NBC/DE Attack	E	E	D	E	D	E	E	12.0) Unit attacked.
13.0		ADA Msn Results	E	E	0	NA	NA	NA	NA	13.0) ADA unit in area, fire msn results.
14.0		FS Results	E	E	D	R	D	NA	NA	14.0) Results of FS mission.
15.0		Routine Log	E	E	E	E	E	E	E	15.0) Request for bean, bullets, benzine.
16.0		Log Status	E	E	E	E	E	E	E	16.0) Essential equipment levels.
17.0		Routine Personnel	E	E	E	E	E	E	E	17.0) Personnel matter status & requests.
18.0		Personnel Status	E	E	E	E	E	E	E	18.0) Specific Soldier needs.
19.0		ADA Status	E	R	0	0	NA	NA	NA	19.0) Weapon posture.
20.0		Maint Posture	E	E	E	R	R	NA	NA	20.0) Vehicle Readiness.
21.0		NBC/DE Posture	E	E	E	E	E	E	E	21.0) Current protection level.
22.0		SITREP	E	E	E	E	E	E	E	22.0) Situation Report.
23.0		Shell Report	E	E	E	E	E	E	E	23.0) Threat incomming indirect fire.
24.0		Threat Graphics	E	E	R	R	NA	NA	NA	24.0) Red Force pictures, Ave of approach, locations.
25.0		Target Info								25.0)
26.0		Order of Battle	E	E	D	D	NA	NA	NA	26.0) Threat composition.

Figure 2-3

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C4 Relationships

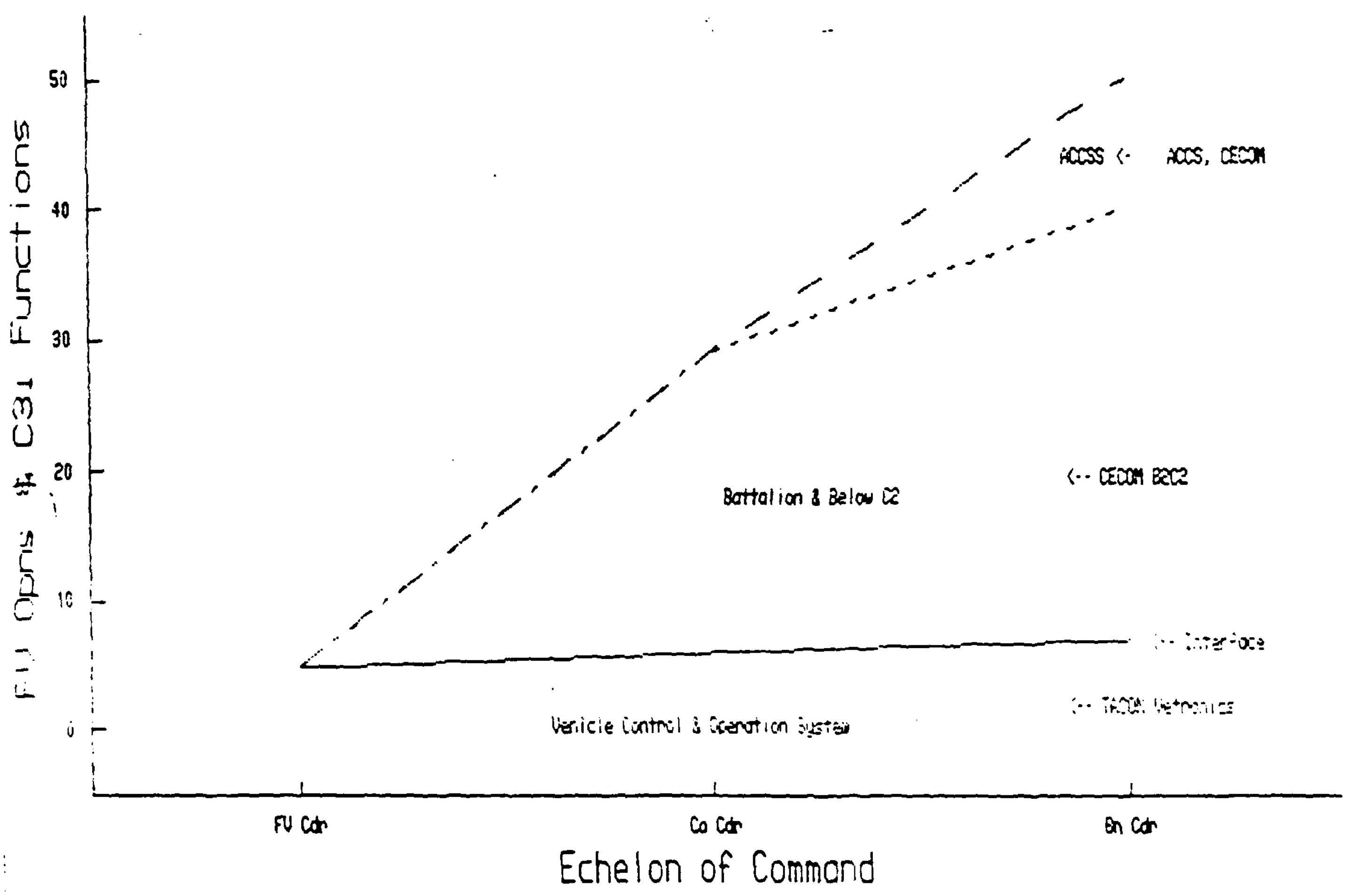

Figure 2-4

2.3.2 Tactical Information and Feedback

Tactical information and feedback is the receipt of tactical command and control information or status. Data bases are updated and printed or visual reports are provided.

2.3.3 Functional C3I

Multiple mission area (such as engineer, fire support or air defense) direct support information must be processed and provided to the chain of command.

2.3.4 Functional [C3I] Feedback

Foremost in C3I feedback is the acknowledgement of receipt of functional C3I mission support information and data.

2.3.5 Reconnaisance, Surveillance, Target Acquisition (RSTA), and Intelligence

The AFV must be capable of receiving tactical intelligence and developing the threat picture.

2.4 AFV VEHICLE CONTROL AND OPERATING SYSTEM (VCOS)

The AFV Fighting Vehicle requirements for automation and communication includes potentially 17 major subsystems and modules. VCOS is the electrical system architecture (automated, communication, and interface components) resource manager capable of painting a well organized standard picture for the FV crew. Figure 2-4 shows that basic VCOS functions remain the same or slightly increased based on the FV support position in the chain of command. Figure 2-5 shows the VCOS basic elements and distribution across the chain of command. Figures 2-6 and 2-7 show the distribution across the AFV fleet and summarizes the competing requirements for bussing and communications that must be supported by a VETRONICS architecture. It is expected that the VCOS will host or directly support the AFV required B2C2 system. Tank and Automotive Command (TACOM) is the expected government VCOS materiel developer. CAC is the combat developer. Discussions concerning VCOS hardware, software, firmware, communications, and modules follow.

2.4.1 VCOS Software

VCOS software runs or manages the AFV subsystem components tied into a common VETRONICS data bus(es) and architecture. The VCOS software provides all automated internal vehicle functions and the interface to B2C2 and ACCS functional systems.

2.4.2 VCOS Hardware

The VCOS hardware provides hardware access to the VETRONICS bus and computer memory and storage for executing vehicle and fire control. It must support ACCS functional and B2C2 software/hardware. All hardware must be hardened against the directed energy threat.

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AFV Control and Operating System Distribution

Item No.	Type Information	Content	Bn Cdr & Staff	Co Cdr	XO, 1SG	Plt Ldr	Plt Sgt	Sec/ Sqd Ldr	Fighting Vehicle (FV) Cdr	NOTES/COMMENTS (Reference the item number, on left)
100.0	VEHICLE	Vehicle Opns Sys	E	E	E	E	E	E	E	100.0) Integrated and controlled vehicle operations.
101.0	CONTROL	Data Bus Control	E	E	E	E	E	E	E	101.0) VERONICS Architecture, ALL AFV.
102.0	and	Diagnostics	E	E	E	E	E	E	E	102.0) Automotive and Electrical Sys Status.
103.0	OPERATIONS	Prognostics	E	E	E	E	E	E	E	103.0) Equipment about to or may deadline vehicle.
104.0		Weapon Control	D	E	E	E	E	E	E	104.0) Integrated fire control system.
105.0		Environment Control	E	E	E	E	E	E	E	105.0) Inside temperature, fire extin and NBC protect.
106.0		Vehicle Status	E	E	E	E	E	E	E	106.0) Organized vehicle summarized status.
107.0		Communications	E	E	E	E	E	E	E	107.0) External communication support.
108.0		Training	E	E	E	E	E	E	E	108.0) Embedded, 3 levels of expertise auto control.
109.0		Vehicle Defense	R	R	R	R	R	R	R	109.0) Integrate detection & reactive sys suites.
110.0		Work Stations	E	E	E	E	E	E	E	110.0) Integrated Duty work station w/ auto support.
111.0		Mission Support	E	E	E	E	E	E	E	111.0) Mission automatic support.
112.0		Network Support	E	E	E	E	E	E	E	112.0) Unit level tied together for commo support.
113.0		Position Navigation	R	R	R	R	R	R	R	113.0) Location.
114.0		Crew Communication	E	E	E	E	E	E	E	114.0) Communicate within Fighting Vehicle (FV).
115.0		Special Equipment	E	E	E	E	E	E	E	115.0) Special mission support equipment.
116.0		ACCS Interface	E	E	E	R	R	O	O	116.0) Army C2 System Interface.
.0		Power Spt, Eng&Aux	E	E	E	E	E	E	E	117.0) Maintain Operation of equipment.

E= Essential, R= Required, D= Desired, O= Optional

VEHICLE CONTROL AND OPERATING SYSTEM (VCOS) ELEMENTS

VCOS Item No.	Type Information	Information Content	Battalion Principal	Staff Action/ Interest	Subordinates on Net	Type Net	Dedicated Battalion & below Reqt	Battalion & Below Interface	ACCS Feeder Support
100.0	Vehicle	Vehicle Opns Sys	XO	S3/BMO/ALL	NA	Internal	YES	All	B2C2/IVIS
101.0	Control &	Data Bus Control	SIG OFF	S3/BMO/ALL	NA	Internal	YES	NA	IVIS**
102.0	Operations	Diagnostics	SIG OFF	S3/BMO/ALL	NA	Internal	YES	NA	IVIS
103.0	System	Prognostics	SIG OFF	S3/BMO/ALL	NA	Internal	YES	NA	IVIS
104.0	(VCOS)	Weapon Control	S3	BMO/ALL	NA	Internal	YES	NA	IVIS
105.0		Environment Control	S3	S4/BMO/ALL	NA	Internal	YES	NA	IVIS
106.0		Vehicle Status	S3	BMO/ALL	NA	Internal	YES	As required	IVIS
107.0		Communications	SIG OFF	S3/BMO/ALL	NA	Internal/External	YES	As required	IVIS
108.0		Training	S3	ALL	NA	Internal	YES	NA	IVIS
109.0		Vehicle Defense	S3	ALL	NA	Internal	YES	NA	IVIS
110.0		Work Stations	SIG OFF	S3/BMO/ALL	NA	Internal	YES	NA	IVIS
111.0		Mission Support	S3	ALL	NA	Internal	YES	As required	IVIS
112.0		Network Support	SIG OFF	S3/BMO/ALL	Unit *	--	YES	As required	IVIS
113.0		Position Navigation	S3	ALL	NA	?	YES	?	IVIS
114.0		Crew Communication	SIG OFF	ALL	NA	NA	YES	NA	IVIS
115.0		Special Equipment	S3	BMO/ALL	NA	NA	YES	NA	IVIS
116.0		ACCS Interface	S3	BMO/ALL	NA	NA	YES	NA	IVIS
117.0		Power Support	S3	BMO/ALL	NA	NA	YES	NA	IVIS
				* Squad/PLT		** InterVehicle Information System (non-ACCS)			

Figure 2-5

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VCOS VETRONICS Architecture

No.	FV No.	FV MISSION (AFV TASK FORCE \ SUB-SYSTEM ->)	214.0 RETROFIT	217.0 AUX PWR	212.0/214.0 EXT LOCAL AREA NET-WORK	210.0 MISSION WORK STATION(S) DRIVER	GUNNER	CDR	FV STAFF	212.0 POSITION NAVIGATION POS-ITION	AZ-MUTH	DIG-ITAL SPT	216.0 ACCS Inter-face	208.0 VEHICLE DEFENSE SNSR SUITE / REACT SUITE	207.0 DATA DISTRIB EPUU / CDR	207.0 AREA COMMO MOBILE TELE	207.0 COMMO CNTRL S/CEOI	207.0 COMBAT NET RADIO (CNR) SNT RNG / LNG RNG	216.0 BM C3I SYS MOD-ULE	204.0 FIRE & WEA-PON CON-TROL	NBC DET-ECT, PRO-TECT; ENV LIFE	204.0 FIRE EXTING SUP-PRES; CNTRL SUPPORT	208.0 TRAINING				211.0/215.0 MAINT EQUIP OR SUPPT MOD-ULE	206.0 CSS STAT-US MOD-ULE	209.0 VEHICLE CNTRL OPER-TIONS MODULE	207.0/214.0/211.0 VOICE RECOG (P3I)	202.0,203.0 AUTOMATIC LOGBOOK EXT TVCE SYS	EMBD DIAG PROG	BIT	BITE
1	FV-2	INF FIGHT VEH (IFV)	R	E	E	E	E	E		R	D	D		E	E		E	E	E	E	E	E	R	D	E	E	E	E	E	O	D	E	R	O
2	FV-8	RECOVERY	R	E	E	E	E	E		R		D		R	E		E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
3	FV-1	TANK	R	E	E	E	E	E		R	-R	D		E	E		E	E	E	E	E	E	R	D	E	E	E	E	E	O	D	E	R	O
4	FV-2	SAPPER	R	E	E	E	E	E		R		D	D	E	E	O	E	E	E	D	E	E	R	D	E	D	E	E	E	O	D	E	R	O
5	FV-2	RECON	E	E	E	E	E	E		E	E	D	O	E	E		E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
6	FV-2	CEV	R	E	E	E	E	E		R	R	D		E	E		E	E	E	E	E	E	R	O	E	E	E	E	E	O	D	E	R	O
7	FV-2	FIST	R	E	E	E	E	E	R	E	E	D	R	E	E	R	E	E	E	D	E	E	R	D	E	D	E	E	E	O	D	E	R	O
8	FV-2	AMBUL	R	E	E	E	E	E		R	R	O		D	E		E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
9	FV-2	CP/FP	R	E	E	E	E	E	E	R	O	D	E	E	E	E	E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
10	FV-10	BRIDGE	R	E	E	E	E	E		R		D		R	R		E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
11	FV-3	LOSAD	R	E	E	E	E	E		R	R	D		E	E		E	E	E	E	E	E	R	D	E	E	E	E	E	O	D	E	R	O
12	FV-3	LOSAT	R	E	E	E	E	E		R	R	R		E	E		E	E	E	E	E	E	R	D	E	E	E	E	E	O	D	E	R	O
13	FV-11	COUNTER MOB VEH (CMV)	R	E	E	E	E	E		R		D		R	R		E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
14	FV-11	CEM	R	E	E	E	E	E		R	O	D		O	R		E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
15	FV-6	HOWITZER	R	E	E	E	E	E		E	E	D		R	E		E	E	E	E	E	E	R	D	E	E	E	E	E	O	D	E	R	O
16	FV-7	REARM	R	E	E	E	E	E		R	O	O		R	E		E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
17	FV-7	RESUPPLY	R	E	E	E	E	E		R	O	D		D	R		E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
18	FV-7	REFUEL	R	E	E	E	E	E		R	O	D		R	E		E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
19	FV-7	MAINT	R	E	E	E	E	E		R	O	D		D	R		E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
20	FV-7	NBCRS	R	E	E	E	E	E		R	R	D	O	E	E		E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
21	FV-7	SMOKE	R	E	E	E	E	E		R	O	D		O	O		E	E	E	E	E	E	R	D	E	E	E	E	E	O	D	E	R	O
22	FV-7	RADIO	R	E	E	E	E	E		R	O	D		O	R	R	E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
23	FV-7	MORTAR	R	E	E	E	E	E	E	E	E	D	E	R	E	D	E	E	E	E	E	E	R	D	E	E	E	E	E	O	D	E	R	O
24	FV-7	MOV	R	E	E	E	E	E		R	O	O		R	R		E	E	E		E	E	R	O	E		E	E	E	O	D	E	R	O
25	FV-4	NLOS AT/AD	R	E	E	E	E	E		E	E	D		R	E		E	E	E	E	E	E	R	D	E	E	E	E	E	O	D	E	R	O
26	FV-9	C2V	R	E	E	E	E	E	E	R	O	D	E	D	E	E	E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
27	FV-9	ETAS	R	E	E	E	E	E	E	R	R	D	E	E	E	E	E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
28	FV-9	IPV	R	E	E	E	E	E	E	R	R	D	E	E	E	R	E	E	E		E	E	R	D	E		E	E	E	O	D	E	R	O
29	FV-6	RCKT	R	E	E	E	E	E	R	R	R	D	R	R	E		E	E	E	E	E	E	R	D	E	E	E	E	E	O	D	E	R	O
30	FV-4	MS.	R	E	E	E	E	E	R	R	R	D	R	R	E		E	E	E	E	E	E	R	D	E	E	E	E	E	O	D	E	R	O

E= Essential, R= Required, D= Desired, O= Optional

Figure 2-6

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AFV Mission Module Distribution

Item No.	Type Info	Type Capability	Bn Cdr & Staff	Co Cdr	XO, 1SG	Plt Ldr	Plt Sgt	Sec/ Sqd Ldr	Fighting Vehicle (FV) Cdr	NOTES/COMMENTS (Reference the item number, on left)
	FV Number	Module Distribution								
1	FV-2	INF FIGHT VEH (IFV)				X	X	X	X	1
2	FV-8	RECOVERY						X		2
3	FV-1	TANK				X	X	X	X	3
4	FV-2	SAPPER				X	X	X	X	4
5	FV-2	RECON				X	X	X	X	5
6	FV-2	DEW					X	X		6
7	FV-2	FIST		X						7
8	FV-2	AMBUL					X	X	X	8
9	FV-2	CMPGP	X	X	X	X				9
10	FV-10	BRIDGE						X	X	10
11	FV-3	LOSAD						X	X	11
12	FV-3	LOSAT						X	X	12
13	FV-11	COUNTER MOB VEH (CMV)						X	X	13
14	FV-11	CEM						X		14
15	FV-5	HOWITZER						X		15
16	FV-7	REARM						X		16
17	FV-7	RESUPPLY						X		17
18	FV-7	REFUEL						X		18
19	FV-7	MAINT						X		19
20	FV-7	NBCRS						X		20
21	FV-7	SMOKE							X	21
22	FV-7	BNAID				X			X	22
23	FV-7	MORTAR						X		23
24	FV-7	MDV							X	24
25	FV-4	NLOS AT/AD						X		25
26	FV-9	C2V	X	X		X				26
27	FV-9	ETAS	X							27
28	FV-9	IEW	X							28
29	FV-6	ROKT				X				29
30	FV-6	MSL				X				30

Figure 2-7

2.4.3 VCOS Firmware

Hardware items containing microcode programming will be supported by VCOS when performance requirements dictate.

2.4.4 VCOS Communications

For the purposes of integration ACCS communication subsystems will be treated as a VCOS component. From a B2C2 requirement definition point of view communication subsystems (except the intercom) will be treated as C2 components.

2.4.4.1 Intercom

The FV intercom susbsystem provides internal voice communications to all crew members. Intercom should be capable of operating combat net radio operations and be product improved for voice [computer] recognition.

2.4.4.2 Auxillary Power

Auxillary power is required to support all vehicular electrical systems whenever the main engine is not operating. Auxillary power will be generated by an Auxillary power unit and batteries. This is an AFV common requirement.

2.4.4.3 Local Network

At the unit level, communications support is provided by the local network through physical connection (wire, fiber optics, etc) or data communications.

2.4.4.4 Mission Fighting Station

Each FV crew member operates a driver, commander, gunner, or staff member station that provides information and accepts commands for the operation of vehicular and external functions appropriate to that station. Fighting Station components include displays, controls, input, and output devices. This station will serve as the soldier's integrated cockpit. (See para 2.5, Standard Crew Interface).

2.4.4.5 Position Navigation

This subsystem provides accurate positional and navigational information based on the FV mission.

2.4.4.6 Army Command and Control System Interface

The ACCS generally provides C3 at the Brigade and higher levels. Selected AFV subsystems may contain ACCS modules to support their specific mission. For example: the Fire Support Team (FIST) will have a AFATDS module and the Resupply module may have a CSSCS module. This VCCS design module may contain the B2C2 system.

2.4.4.7 Vehicle Defense

Active defense with passive and active sensor subsystems will be computer assisted to provide high speed defensive solutions based on the FV's available offensive and defensive weapon systems.

2.4.4.8 Data Communication

Internal data communication is supported by the VETRONICS bus architecture. External data communication is supported by local combat net radio, and area communications.

2.4.4.9 Area Communication

Area communications networks provide communications to higher and lower units. Area communications will be used primarily by the chain of command.

2.4.4.10 Voice Communication

Voice communication capability is provided by area, local, and intercom systems. Voice communications is required for all AFV subsystems.

2.4.4.11 Communication Control

Manual and automated procedures and protocols are used to maintain control of communications systems. This control function will have a prioritization capability.

2.4.4.12 Fire and Weapon Control

FV weapons and fire control systems include target acquisition, identification, weapon selection, and adjustment of fire functions. These functions are integrated and have processing priority.

2.4.4.13 Environment Control and Life Support

Crew and engine temperature, fire extinguishing and NBC protection control modules comprise this system.

2.4.4.14 Embedded Training

Training covering all facets of vehicle control and operation are embedded and available at vehicle fighting stations. Embedded training should cover the ability to shoot, maintain, and operate the vehicle. Maintenance and operations training modules are family common. A special mission support module should be available for special equipment and operations. See paragraph 2.5 for further information.

2.4.4.15 Special Mission Support Module

Specialized vehicles such as the Bridge subsystem will require a special software/hardware module for bridge erection and recovery. Another example is a remote piloted vehicle control module which may be housed in the AFV command group or intelligence vehicle.

2.4.4.16 Combat Service Support Module

This module will provide automatic (or on command) vehicle status to a high echelon of command. This module should be compatible with the Combat Service Support Control System.

2.4.4.17 Automatic Logbook

The family common required automated logbook compiles maintenance, diagnostic, and prognostic information for the AFV. Logbook data and module must be compatible with test maintenance and diagnostic equipment (TMDE) and be able to capture Built-in test data from VETRONICS subsystems. The prognostics module will initially capture vehicle sensory data (fluid and power levels) and technical manual (TM) repair schedules to project problem areas via display or audio signals. Prognostics module computational power must be preplanned product improved (P3I) capable. The automatic logbook should have the capability to run as a background task without degrading mission priority automation and communication systems.

2.5 AFV STANDARD CREW INTERFACE - HUMAN FACTORS ENGINNERING

The number and complexity of the automated functions available in a Fighting Vehicle (FV) requires a standard crew interface to be developed and imposed on hardware (data entry and displays) and on applications software (to include embedded training) in the FV. This level of standardization is envisioned to reduce training costs.

2.5.1 Human Factors

The standard crew interface will specify standard formats, sequences, procedures, performance criteria, meanings, responses, colors, audibles, and functions for software and hardware interaction with the FV crew.

2.5.2 Embedded Training

In addition to compliance with the standard crew interface, embedded training standards for on-line help functions, tutorials, practice sequences, performance evaluation, audits, and template or macro functions will be specified and implemented. Developed embedded training will support vehicle and crew operations, vehicle maintenance, and conduct of fire. Collective training (above vehicle crew level) will be initially supported by a tethered local network. A stand-alone (non-AFV) computer may be required to drive the system. User and maintenance documentation will be developed concurrently. The Combined Arms Center will develop common training requirements while the TRADOC schools will ensure mission unique requirements are properly developed. The AMC developer is to be determined.

2.5.3 Standard Crew Interface Specifications

The Interface Control Board (ICB) and Human Factors & Training Board (HFTB) operating under the Automation and Communication Resource Working Group will be responsible for the development and specification of the standard crew interface. The HFTB will also represent the ACRWG in training and other human resources matters.

2.6 METHODOLOGY

The methodology for identifying proponent agencies for management of the development and support of AFV C3 resources relies on the analysis of requirements. Figure 2-8 shows requirements, responsible agencies, planned deployment level, and level of FV need for each capability. Requirement analysis, refinement, and development will be a continuous process throughout the AFV life cycle. This cycle will be supported by the AFV Technology Assessment Program to ensure state of the art and cost effective technology (and system) are captured for the AFV.

2.6.1 Proof of Principle (POP) Phase

Identified activities (Chapter 3, Program Management) will play an important role in the specification, design, and acquisition management of the AFV computer resources. During the POP Phase of the AFV acquisition, three independent contractor efforts to this analysis are expected to contribute to the final methodology for development of the automation and communications resources needed for the AFV. POP will be completed for the initial AFV fielding by FY 89 when Milestone I/II decision will be made. At this time, AFV products as listed in Appendix E, AFV Requirement and Planning Documents will be completed.

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Battalion C3I

Project Integration Required Actions

Mat Ref No.	Project or Capability	Combat Developer	Materiel Developer	Current Planned Deployment, Lowest Level	Planned B2 C3I Integration?	What's Needed at Battalion and Below	AFV Lowest Level of Need	Comments
216.0	Army C2 System(s)	CAC	CECOM	Brigade	NO	B2C2 interface.	All Elements.	216.0 Implement B2C2 w/ ACCS.
216.1	Maneuver Control System	CAC	CECOM	Brigade	NO	Feed B2C2.	PLT LDR	interfaces.
216.2	Adv Field Art Tactical Data Sys (AFATDS)	FA School	CECOM	FIST	YES	Feed B2C2.	——	
216.3	Forward Area ADA Command&Control Intel	ADA School	MICOM	ADA SOD	NO	ADA Adv Warning.	SOD	216.1 Use ACCS subsets to formulate the
216.4	Combat Service Spt Control System	LOGCEN	?	CSS BN	NO	S1/S4 Support.	SOD	thru the B2C2 system,
216.5	All Source Analysis System (ASAS)	INTEL	PM JTF	MI BN	NO	S2 Support.	SOD	216.5 and support Bn staff.
216.6	Battalion & Below Cmd and Ctrl (B2C2)	CAC/AR SCH	CECOM	NONE	NO	Must Develop.	All Elements	216.6 Ltd CAC Spt for B2C2, cept BMS/IVIS
207.5	Combat Net Radio (CNR), capability	CAC,SIG	CECOM	Squad	NO	C2 Sys & Vetronic	All Elements	
207.51	Sincgars Short Range Radio (CNR)	CAC,SIG	CECOM	Squad	NO	integration.		
207.52	Sincgars Long Range Radio (CNR)	CAC,SIG	CECOM	Squad	NO	All Vehicle inter-		
207.53	Radio Other Data Distr, capability	CAC,SIG	CECOM	?	NO	faces defined and	?	
207.55	Enhanced PLRS User Unit (EPUU)	CAC,SIG	CECOM	Platoon	NO	scope of VETRONICS		
207.56	Sincgars Radio Area Comm. capability	CAC,SIG	CECOM	Squad	NO	determined.	All Elements	
207.57	Mobile Subscriber Equip Telephone	CAC,SIG	CECOM	Battalion	NO			
200.0	Vehicle Oper and Control Sys (VOCS)	ARM SCH	TACOM		NA	C3I interface.	All Elements.	200.0 Must supt int. Veh Comms. w/VETRONICS
201.0	Vetronics Architecture	ARM SCH	TACOM	Arm Unit, ALL	NO CAC SPT	See comment above.	All Elements	201.0 Need Army wide Support.
202.0	Diagnostics Module	ARM SCH	TACOM		-	Common FV Module.	All Elements	202.0 Needs Dollars & TMDE interface.
203.0	Prognostics Module	ARM SCH	TACOM			Common FV Module.	All Elements	203.0 $ & TMDE interface. Design for test
204.0	Fire Control System (processors)	ARM SCH	ARDEC		?	Common FC	Selected FV's	
		FA SCH	ARDEC			computer.		
		ADA SCH	MICOM		NA		All Elements	
205.0	Vehicle Environ & Protection System	?	NATICK	?	NA	Common FV System.	All Elements	
206.0	CSS Support Module			Arm Unit			All Elements	
208.0	Training Module(s)	?	TACOM	SOD, Tank	NO	Define Interfaces	All Elements	
208.1	Weapon Firing Module							
208.2	Vehicle Maintenance		ARDEC					
208.3	Vehicle Operation		TACOM				All Elements	
208.4	Sims Interface/Mission Documentation		TACOM				All Elements	208.4 Sim (tethered data link), (Sim is P3I)
209.0	Vehicle Integrated Defense Sys (VIDS)	ARM SCH	TACOM	Arm Unit			All Elements	209.0 Modules may differ
210.0	Displays & Controls	Players:	Players:			Common Displays w/		210.0 Multiple development, multiple
210.1	Gunner	CAC	ETDL			small size. Common		data entry devices.
210.2	Driver	FA SCH	CECOM			controls for AFV.	All Elements	
210.3	Commander	ARM SCH	MICOM				All Elements	
210.4	Tactical	INF SCH						
210.4	Vehicle Status/Handheld Display/Staff Psn	ADA SCH						
211.0	Mission Software Module	?	Many				All Elements	
211.01	Embedded AI Dec Spt Sys	?	Many			Define Tools		
211.02	Voice Recognition (P3I)		AVRDA	Aviation Units	No			211.0 Voice Command to shoot. P3I.
212.0	Local Area Network (LAN) Support	ALL	CECOM				All Elements	
213.0	Vehicle Position Navigation System/EPLRS	CAC	CECOM		NO		All Elements	
	VNAS	AVSCOM	AVRDA	SOD capable	NO	MCS & Vetronics		
	MAPS (refined direction,position)	FA Sch	ARDEC	Howitzer	NO	interface at PLT		
	Global Positioning System (GPS)	CAC	CECOM	Brigade, above	NO	CO level		GPS for higher echelons.
	Digital Topographic Support Syst (DTSS)	ETL	?	Division level	YES			DTSS must support Div Digital reqt's.
	Digital Mapping,Terrain(Video,Paper)	MANY	ETL	Battalion	NO			Need Army Digital Std.
214.0	Vehicle Intercom Sys (VIS)	?	CECOM			Dtermine Vetronic	All Elements	214.0 NDI, Vetronics interface unknown.
	Voice Recognition	AVSCOM	CECOM			interface.		Voice recog cmnd P3I.
215.0	Robotics		HEL	Separate Vehicle		Special Mission	Selected AFV	
215.1	Refuel Manipulator		TACOM			Support Modules &	distribution.	215.0 Need Manipulator
215.2	Rearm Manipulator		ARDEC			Vetronic Control		wrk packages.
215.3	Resupply Manipulator		ARDEC		NO	interface.		215.3 Ammo manip's for FA &
215.4	Smoke Generator Module Control		?					Armor.
215.5	Autoloader	Arm Sch	TACOM/ARDEC				Shooters.	215.5 ARDEC working.
217.0	Main & Aux Power Supply							

Figure 2-8

2.6.2 Development Proveout (DPO) Phase

During DPO, the development of automation and communications resources will depend on the selection of a VETRONICS architecture and its specification, the specification of the Vehicle Control and Operating System (VCOS), and the specification of the interface to the Battalion and Below Command and Control (B2C2) C3I functions. Candidate preplanned product improvements (P3I) or engineering changes will be developed or tested for future AFV fielding.

2.6.3 Production Deployment (P/D) Phase

During P/D of the AFV, rapid and effective support of automation and communications resources will be critical. The establishment and operation of the LCSEC during DPO will permit this key organization to mature early and to develop the management and techniques for effective software support throughout the life cycle of the AFV.

2.7 SUMMARY, REQUIREMENTS ANALYSIS

The analysis of requirements is based on internal and external needs for automation and communication as derived from vehicle control and C3I functions. Appendix G, AFV Integrated C3 when published will contain refined automation and communications requirements.

CHAPTER 3 - PROGRAM MANAGEMENT

3.1 INTRODUCTION - This Chapter of the ACRMP addresses overall AFV computer resources planning and philosophy, and identifies Army agencies and organizations that will be involved in the requirements refinement, acquisition, test, and support of the AFV automation and communication resources.

3.2 PERSONNEL RESOURCES

3.2.1 AFV Task Force - The Task Force staffing will remain relatively stable during Concept Exploration. All automation and C^3I should be brought to the attention of the AFV C^3I project officer (para 1.12). Future organization staffing will be determined at a later date. Potential staffing may include appointed representatives from supporting commands.

3.2.2 Supporting Commands - Supporting commands are required to appoint as a minimum a primary and alternate point of contact to support the AFV automation and communications program. Command Action Officers are expected to manage analysis, design, and planning within their respective commands in an expedited and non-traditional manner.

3.3 MANAGEMENT RESPONSIBILITIES - The implementation of the AFV acquisition strategy requires intensified management effort. Traditional sequential management techniques will not suffice. The scope of AFV is large, resulting in diverse combat developer requirements combined with multiple system engineer or materiel developer approaches to system solutions. Management and their designed representatives must do their part to insure that during;

MATERIEL DEVELOPMENT PHASES	OBJECTIVES
CONCEPT EXPLORATION	DEVELOP CONCEPTS*, DEFINE REQUIREMENTS, TOP LEVEL SPECIFICATIONS*, MANAGEMENT PLANS*, TRADE-OFF AND FEASIBILITY STUDIES*, SYSTEM REQUIREMENT REVIEW.
MS I	CONCEPT SELECTION.
DEMONSTRATION VALIDATION	CONFIRM CONCEPT SELECTION, RISK REDUCTION, REFINE REQUIREMENTS, PROTOTYPES, ESTABLISH FUNCTIONS BASELINE*, START DEVELOPMENTAL BASELINE*, PRELIMINARY SYSTEM DESIGN SPECIFICATION REFINED, ESTABLISH ENGINEERING CENTERS, PRELIMINARY DESIGN REVIEW.
MS II	FULL SCALE DEVELOPMENT APPROVED.
FULL SCALE DEVELOPMENT	COMPLETE SYSTEM DESIGN, PROGRAM AND FABRICATE, FORMAL TESTING*, CRITICAL DESIGN REVIEW, MANAGEMENT PLANS*, FIELDING PLANS*, MANUALS*, TEST AND CRITICAL DESIGN REVIEWS, ESTABLISH PRODUCTION BASELINE*.
MS III	PRODUCTION (DEPLOYMENT) DECISION
PRODUCTION	POSSIBLE CHANGE REQUIREMENTS*, CONTINUED LIFE CYCLE ACTIVITIES*, SYSTEM DELIVERY AND TEST, MANAGEMENT PLANS*, FIELDING PLANS*.
DEPLOYMENT	FIRST UNIT EQUIPPED, CONTINUED LIFE CYCLE ACTIVITIES, PRODUCT IMPROVEMENTS, PREPLANNED PRODUCT IMPROVEMENTS.

*Carried forward to the next phase for refinement and update

AFV Management Objectives
Figure 3-1

A. Concept Exploration - Requirements are defined and analyzed,

B. Demonstration Validation - Requirements are confirmed and design is completed,

C. Full Scale Production - Programming, fabrication and testing is completed with supporting soldier documentation and finally, during

D. Production and Development - The system is ready for fielding and life cycle support is workable.

AFV automation and communication resource development objectives, Figure 3-1, must be attained.

3.3.1 <u>Director, Armored Family of Vehicles Task Force (AFVTF)</u> - The Director, AFVTF has the overall responsibility for the life cycle management, development, and acquisition of the AFV computer resource items, and is responsible for maintenance of the AFV ACRMP. The Director has initiated the establishment of an Automation and Communication Resources Working Group (ACRWG) to aid in the preparation and maintenance of the AFV AACRMP. The primary functions to be performed by the ACRWG include, but are not limited to, the following:

A. Plan for the development, test, integration, production, and support programs and set the criteria for decisions based on all factors that could affect the system life cycle. These include:

- o Operational and support concepts for both hardware and software resource items.
- o Economic constraints.
- o Technology and risk assessment.
- o Tradeoffs between hardware and software applications.
- o Scheduling.
- o Total vehicle electronic architecture integration.

B. Review system integrator and contractor progress during system development and integration and maintain procedures to ensure deployment of the system within program goals.

Ensure timely completion of development and operational testing, and coordinate the test results with the responsible agencies.

D. Ensure that computer resources are properly integrated in the overall AFV system thereby providing for the functional capability required in the automated battlefield environment.

E. Resolve all computer resource conflicts that may develop between the B2C2 interfaces and the VCOS Fighting Vehicle components. Extensive Communication-Electronics Command (CECOM) and Program Executive Office for Communication, Command, Control, and Intelligence & Electronic Warfare (IEW) coordination is expected.

F. Ensure that adequate software documentation is available for effective user and post-deployment support for the fielded AFV.

- o BIT and TMDE integration
- o Support of Microprocessors
- o Ada/Ada Environment Availability
- o Power (weight/size)
- o Software Maturity
- o VETRONICS Interfaces and Interconnections
- o Diagnostics and prognostics, scope
- o Data Distribution Communication Capability
- o Digital Mapping or Terrain Standards
- o Battalion Command & Control Architecture
- o Centralized vs. Decentralized Software Development Management
- o Design for Test Capability
- o Testing of parallel or concurrent programs
- o Common Soldier Machine Interface
- o Dollar Availability
- o ATCCS Interface

Figure 3-2. Risk Concerns

3.3.2 Training and Doctrine Command (TRADOC) - TRADOC is the Combat Developer (CD), User Representative, Trainer, and proponent for the AFV Program. TRADOC is responsible for preparing and updating the Operational and Organizational (O&O) Plan and the Required Operational Capability (ROC) for the AFV Program. The TRADOC designated representative will continually coordinate and validate AFV requirements with the AFVTF, will

AFV COMPUTER RESOURCE INTEGRATION

Responsible Command	Expertise/Technology
ADEA	C3 Testbed, Lessons Learned
AMC	Material Acquisition and Management
AMCCOM	Life Cycle Management-Fire & Weapon Control, NBC
AMSAA	Material Development, Acquisition Analysis, and Development Evaluation
ARDEC	Fire Control, MAPS
ARI	Automated/Embedded Training
ARO	Automation, communication, and engineering research
AVSCOM	Avionics Technology Sharing Program
AVSRDA	VNAS, LHX coordination & technology sharing
BRDEC	Engineer, Power Generation
CAC	User requirement integration, C3I expertise
CACDA	Materiel Integration
CATA	Training
CECOM	ACCS, Army C4, TMDE, POS/NAV, B2C2
CRDEC	NBC Protective System
ETDL	Army VHSIC, Microelectronics, Displays
ETL	Digital Terrain and Mapping
HEL	Human Factors, Standard Soldier/Machine Interface
HDL	Artificial Intelligence Technology
USAHSC	Medical System Plans and Requirements
INSCOM	Threat Analysis, ADP Security
LABCOM	VISTA, Tech Base Support, Target Recognition
LOGCEN	Logistics Support
MICOM	FAADC2I Developers
OTEA	Operational Testing of AFV
SIGCEN	CD/MD Communications Expertise
SSC	Human Factors Concepts and Doctrine
TACOM	Vetronics, Vehicle Defense, Automotive Interface, VCOS
TCATA	Operational Testing of AFV Automation/Communication
TECOM	Developmental Testing AFV Automation/Communications
TRAC	Functional Analysis Support
TRADOC	CD, User Expert, Special Mission Area Expertise, User Representative, Trainer
TROSCOM	Vehicle Environment Control (NBC Temperature Control & Fire Extinguishing)
USAISC	Standard Multicommand Management Information Systems
USALEA	ILS and Logistic Support Planning

Figure 3-3

provide user input, review the ACRMP, and will support the Director in the acquisition, test, and deployment of the AFV. TRADOC subordinate commands are identified in follow on paragraphs. General responsibilities include but are not limited to:

A. Formal definition of the AFV Battalion and Below Command and Control (B2C2) and the Vehicle Control and Operating System (VCOS) Requirements

B. Tailoring of plans and supporting documentation to ensure command, control, communications, and computer resource planning is focused on the AFV.

C. Support of the AFV Automation and Communications Resources Working Group (ACRWG).

D. Develop and refine user requirements for embedded training.

E. Develop and refine common vehicle driver and commander work stations.

F. Provides user perspective for AFV technical demonstrations or prototype tests. Periodic reports may be required.

G. Coordinate with materiel developers and maintain AFV Task Force coordination.

3.3.3 Army Materiel Command (AMC) - AMC is responsible for providing overall computer resource acquisition management guidance for Army Battlefield Automated Systems. Headquarters AMC will review the ACRMP and will coordinate the automation and communication resource and system engineering activities for AFV and TRADOC, and other Army commands, agencies, and other services as appropriate. AMC will maintain all technical data related to development and acquisition of the AFV and will provide technical assistance to developers, contractors, and users as required. AMC subordinate commands are identified in the following paragraphs. General responsibilities include but are not limited to:

A. Tailoring of development plans to support the AFV. Develops AFV hardware and software development and test plans.

B. Focus the Technology Base to support AFV development and candidate Pre-planned Product Improvements (P3I).

C. Manage AFV candidate subsystem or components integration according to AFV management plans. Provides cost estimates.

D. Support ongoing AFV Technology Assessment (see Chapter 7, Plan for Support) to include the Technology Base and systems under Project Management Organizations.

E. Interface AMC products with an AFV common vehicle architecture.

F. Support the AFV Automation and Communications Resources Working Group (ACRWG) and ACRMP review/update.

G. Coordinate with combat developers and maintain AFV Task Force coordination.

3.3.4 <u>Combined Arms Center (CAC)</u> - CAC, the integration center, is responsible for providing concepts, doctrine, and operational environment guidance for the development and maintenance of the AFV command, control (C2), communication and computer resources supporting the fighting vehicle functions, and C2 system tasks.

3.3.4.1 <u>US Army Combined Arms Combat Development Activity (CACDA)</u> - CACDA is responsible for system integration in close coordination with CAC and the Task Force. CACDA serves as the lead user proponent and will define the AFV C3I Architecture of B2C2 and VCOS.

3.3.5 <u>Logistics Center (LOGCEN)</u> - The Logistics Center is responsible for the providing concepts, doctrine, and operational environment guidance for the development and maintenance of AFV computer resources impacted by [illegible] support of the AFV. LOGCEN will serve as the focal point for the [illegible] Service Support Control Systems (CSSCS). LOGCEN will review AFV Architecture developments to ensure interface with the CSSCS is [illegible]

3.3.6 Soldier Support Center (SSC) - SCC develops, reviews, evaluates, and conducts appropriate human factor concepts and doctrine. Integrating Center with TRADOC schools, training activities, and other integrating centers for AFV automation and communication human factors analysis.

3.3.7 Communication and Electronics Command (CECOM) - CECOM serves as the focal point for AFV communications, electronic equipment, and Army Command and Control System (ACCS) development, acquisition, and fielding support. CECOM will ensure Army Tactical Command and Control System (ATCCS) interface with AFV required Battalion and Below Command and Control (B2C2) system. CECOM will develop B2C2 and support AFV VETRONICS Architecture integration. CECOM will act as a lead agency for Command, Control, Communication (C3) and Intelligence Electronic Warfare (IEW).

3.3.8 Tank and Automotive Command (TACOM) - TACOM is responsible for the AFV study contracts, automotive equipment, and an AFV common vehicle electronic architecture, supported by an AFV required Vehicle Control and Operating System (VCOS). TACOM will serve as the VCOS developer and lead agency. Extensive coordination with the Battalion & Below Command and Control (B2C2) developers and the Task Force is expected.

3.3.9 Armament, Munitions, and Chemical Command (AMCCOM) - AMCCOM perform overall life cycle management for AFV fire and weapon control, Nuclear, Biological, Chemical (NBC) protection systems.

3.3.9.1 Armament Research Development Engineering Center (ARDEC). - ARDEC will serve as the AFV focal point for AFV fire and weapons control.

3.3.9.2 Chemical Research and Development Engineering Center (CRDEC) - CRDEC will serve as the AFV focal point for NBC protection system.

3.3.10 Missile Command (MICOM) - MICOM is responsible for special mission packages for designated AFV subsystems. Coordination between CECOM and AFVTF regarding the Forward Area Air Defense Command, Control & Intelligence (FAADC2I) system development and integration required.

3.3.11 Troop Support Command (TROSCOM) - TROSCOM will work in concert with AMCCOM for development support of the AFV environment control system (NBC protection, fire extinguishing, and temperature control).

3.3.12 Belvoir Research Development Engineering Center (BRDEC) - BRDEC is responsible for development and support of the resupply manipulator technology for the AFV.

3.3.13 Laboratory Command (LABCOM) - LABCOM is responsible for monitoring Army technology base for the AFV program and reports finding to the Task Force. Serves the point of contact for the AMC/AFVTF Technology Assessment refinements. CECOM coordination is required.

3.3.13.1 Human Engineer Laboratory (HEL) - HEL conducts human factors qualitative, and quantitative analysis for AFV. Primary advisor to combat development and materiel development communities on human factor issues. As the chair of the AMC/TRADOC Robotics Task Base Group (RTBG), HEL will monitor RTBG membership projects for AFV applications.

3.3.13.2 Harry Diamond Laboratory (HDL) - HDL is responsible for robotics and artificial intelligence systems support related to the AFV. The AMC/TRADOC Artificial Intelligence (AI) Tech Base Group (AITBG), chaired by HDL will review and monitor the DA/DOD AI Technology Base for AFV applications. Findings will be reported and updated. HDL will provide recommendations for selected portions of the Technology Assessment. HDL will assume the AFV lead in Target Acquisition, Combat Identification, directed energy (DE) and electro-magnetic pulse (EMP) protection.

3.3.13.3 US Army Electronic Technology & Devices Lab (ETDL) - ETDL is responsible for development and acquisition of the microelectronics and displays for the AFV.

3.3.14 Test and Evaluation Command (TECOM) - TECOM is responsible for all government developmental testing for the AFV communication and automation system. Responsible include test planning, the conduct of testing, specification analysis, and result reporting. Scope of testing includes AFV subsystem compact through the entire vehicle electronic architecture.

3.3.15 Operational Test and Evaluation Agency (OTEA) - OTEA is responsible for continuous and comprehensive evaluation which includes operational testing of the AFV. OTEA will support the AFVTF by participating in the planning and developing of all operational testing required to test the AFV in an operational environment.

3.3.16 US Army Logistics Evaluation Agency (USALEA) - USALEA will provide assistance to the AFVTF in developing logistic support planning and will participate in the review of developmental efforts for logistical implications and adequacy of Integrated Logistic Support (ILS) planning.

3.3.17 US Army Development and Employment Agency (ADEA). - ADEA is responsible for command, control, and communications (C3) testing and development. Coordinates with the Task Force for lessons learned and ongoing test results.

3 3.18 U.S. Army Materiel Systems Analysis Activity (AMSAA) - Reviews the AFV materiel development and acquisition processes for vehicle electronic and computer resources. Serves as the independent evaluator.

3.3.19 TRADOC Analysis Command (TRAC) - TRAC is responsible for providing functional analysis support for the AFV program. Performs analyses, studies, and evaluations of AFV automation and communication requirements. Provide technical assistance in test planning, requirement definition refinements, and design reviews.

3.3.20 TRADOC Combined Arms Test Activity (TCATA) - TCATA in coordination with CAC and the Task Force will plan, execute, and report on operational tests for the purpose of determining AFV automation and communication effectiveness.

3.3.21 TRADOC Service Schools - General responsibilities include but are not limited to:

A. Develop or refine Battalion and Below Command and Control (B2C2) and Vehicle Control and Operating System (VCOS) requirements in coordination with the Task Force and TRADOC proponent.

B Develop plans and specifications for mission specific expert or decision support systems for initial AFV fielding or as P3I candidates.

C. Monitor AFV materiel development activities and plans to ensure school or center mission area requirements are properly accounted for and implemented.

D. Develop and refine mission unique embedded training requirements.

E. ACRWG support and ACRMP review.

3.3.21.1 Air Defense School - Serve as Forward Area Air Defense Command Control Intelligence (FAADC2I) user/expert. Develop Battalion and Below Command and Control (B2C2) system direct and automatic interface.

3.3.21.2 Armor School - Share Battlefield Management System (BMS) expertise. Continue BMS development for fielding as the optimal AFV P3I

Battalion C2 system, (the AFV B2C2 system is the target Battalion C2 system for fielding). Coordinate with the Vehicle Control and Operating System (VCOS) materiel developer (hardware/software).

3.3.21.3 Chemical School - Serve as the AFV Environmental Control System user expert.

3.3.21.4 Engineer School - Develops engineer computer related resource requirements. Serve as the AFV trafficability and terrain analysis user expert.

3.3.21.5 Field Artillery School - Serve as Advanced Field Artillery Tactical Data System (AFATDS) user/expert. Develop B2C2 system direct interface at the Battalion and Company levels. Lead coordination with the Air Defense and Infantry Schools and Centers regarding fire control automation and communications matters. Coordinate with the VCOS materiel developer.

3.3.21.6 Infantry School - Coordinate with the VCOS materiel developer. Ensure the VCOS is capable of supporting Infantry requirements.

3.3.21.7 Intelligence Center and School - Serve as the All Source Analysis System (ASAS) user/expert. Develop plans for direct B2C2 interface.

3.3.21.8 Missile and Munition Center and School - Serve as the AFV user representative for munitions. Coordinates with fire control combat and materiel developers, as required. Ensure ammunition is capable for use with AFV autoloaders and robotic like manipulators.

3.3.21.9 Military Police School - To be determined (TBD).

3.3.21.10 Ordnance Center and School - Serve as user/expert for AFV diagnostics and prognostics. Support AFV Automated Logbook development.

3.3.21.11 Quartermaster School - Serve as user expert for AFV refuel, rearm, and resupply robotic manipulators. Maintain close coordination with LOGCEN.

3.3.21.12 Signal Center - Serve as combat information, voice, and data communications expert. Conduct communications traffic studies to support AFV B2C2 and VCOS systems.

3.3.21.13 Transportation School - TBD.

3.3.21.14 Aviation School - Monitor AFV development requirements to ensure ground-to-air and air-ground communications are planned for and effected within the AFV C3I Architecture.

3.3.21.15 JFK Special Warfare Center - Review AFV automation and communications plans to ensure AFV specifications, designs, and products will not prohibit special operations in a close combat heavy environment.

3.3.22 Intelligence and Security Command (INSCOM) - INSCOM is responsible for performing a threat analysis of the AFV and to provide advice and guidance to the AFVTF, ACRWG, and Material Developers regarding system security.

3.3.23 Information Systems Command (USAISC). - Serve as the primary focal point for Standard Multicommand Management Information System (STAMMIS) hardware and software. Provide necessary technical and managerial support for potential future plans to interface the B2C2 system with the appropriate STAMMIS, via a common communication medium with selected combat command and control system(s).

3.3.24 US Army Engineering Topographic Labs (ETL) - ETL is responsible for development of electronic map representation and topographic tools for AFV. Will coordinate a data base design and software tools for AFV tactical use.

3.3.25 U.S. Army Health Services Command (HSC) - HSC is responsible for developing VCOS medical embedded systems. HSC will coordinate with the designated TRADOC AFV subsystem representative and develop user plans and documents for a tactical expert system for AFV ambulance and Battalion Aid Station use.

3.3.26 Aviation System Command (AVSCOM) - Coordinates an Avionics technology sharing program with the AFV Task Force. Expected participants are the Avionics Research and Development and Applied Technology Labs.

3.3.27 US Army Research Office (ARO) - ARO is responsible for focusing automation, communication, and engineering research effort toward AFV improvement.

3.3.28 US Army Research Institute (ARI) - ARI will assist in AFV training support and planning. Will ensure automation support in the force of embedded training is incorporated into training plans with planned functional growth.

3.3.29 System Integrator - The specific responsibilities of the AFV System Integrator (PEO or Task Force contractor for System Engineering/Technical Assistance) will continue to be refined during the AFV materiel acquisition process. Anticipated responsibilities include:

A. Planning and implementing the design, development, and production of the AFV in accordance with the AFV requirement and contractual baseline.

B. Direct and control the efforts of the ACRWG Integration Team for the integration and test of AFV computer resources.

C. Conduct design reviews in accordance with the contractual baseline, development schedule, and good engineering practices.

D. Establish and execute an independent quality assurance program for the contract.

E. Ensure that necessary communication and computer resource documentation is produced, maintained, and controlled during the development and production phases of the contract.

F. Ensure that all deliverables specified in the Contract Data Requirements List (CDRL) for the computer resources are produced and delivered in accordance with the program schedule and contractual baseline.

G. Provide support for the resource items as specified in the contract.

H. Ensure VETRONICS interface and integration.

I. Ensure command and control supportability.

J. Coordinate the acceptance testing and maintenance of any commercial computer resource items for integration with contractor developed software.

Until a System Integrator is designated, these functions will be accomplished by the Automation and Communication Resource Working Group (ACRWG).

3.3.30 <u>AFV Working Groups and Boards</u> - AFV working groups and boards will support the AFVTF with top level guidance, advice, and technical expertise in specialized areas.

3.3.30.1 <u>AFV Retired Board of Governors</u> - The Retired Board of Governors will periodically review AFVTF programs and progress and will make recommendations to the Task Force pertinent to the AFV program.

3.3.30.2 Removed - reserved for future use.

3.3.30.3 Automation and Communications Resources Working Group (ACRWG) The ACRWG will act for the AFVTF on those matters pertaining to the development and fielding of automation and communications resources for the AFV. The ACRWG will operate supporting boards and committees and will maintain this ACRMP. Review the ACRWG Charter at Appendix C.

3.3.30.4 AFV Test Integration Working Group - The Test Integration Working Group (TIWG) will act for the AFVTF on all matters involving testing of the AFV or its components. The TIWG will support the Test and Evaluation Master Plan (TEMP) development and review the ACRMP for specific automation and communication resource testing issues.

3.3.30.5 AFV Maneuver Working Group - Will assist in the AFV automation and communication requirement development. Reviews AFV requirements documents to ensure integrated Command, Control, Communication, Intelligence are properly addressed and provides recommendations to improve the ACRMP.

3.3.30.6 AFV MANPRINT Working Group - The MANPRINT Working Group reviews, develops, and resolves AFV human factors issues. The family common soldier/machine interface is of primary concern. This group will review the ACRMP to ensure human factors engineering is properly planned.

3.3.30.7 AFV Logistics Management Working Group - The logistics Group is primarily responsible for assisting in AFV Logistic Management and Acquisition Strategies. This group will review the Integrated Logistics Support Plan (ILSP) and ACRMP to ensure consistency.

3.3.30.8 AFV Analysis and Simulation Working Group - This group is responsible for developing supporting analysis and simulation for

modeling) effort for the AFV concept formulation process leading toward an AFV required operational capabilities (ROC) document. This group will insure C3I requirements are incorporated in the analytical efforts.

3.3.30.9 <u>AFV Training Development Working Group</u> - Training requirements and development efforts will be initiated and monitored by this group.

3.3.31 <u>Government Management and Working Groups</u> - Applicable Government management and working groups will participate in the development of the AFV and will ensure that related system developments conform to the AFV program.

3.3.31.1 <u>General Officer Steering Committees (GOSC)</u> - Selected GOSC's will provide guidance on the direction and integration of related systems development.

3.3.31.2 <u>Standard Army VETRONICS Architecture (SAVA) Management Steering Committee</u> - The SAVA steering committee will be responsible for providing guidance and direction to the VETRONICS developers in support of AFV. The SAVA committee will closely coordinate with the Task Force.

3.3.31.3 <u>Army Command and Control System, Life Cycle Software Engineering Centers</u> - The ACCS Life Cycle Support Centers (or centers for Life Cycle Engineering) will provide data and assistance to ensure that the AFV interfaces correctly with external battle control automated functions. Reviews ACRMP for content accuracy and provides recommendation for document improvement.

3.3.31.4 Robotics Tech Base Group (RTBG) - The AMC/TRADOC Robotics Technology Base Group, chaired by HEL will identify robotics technology and assist in requirements development for AFV. The RTBG will review the ACRMP to ensure robotic developments are properly managed within the AFV program.

3.3.31.5 Artificial Intelligence Tech Base Group (AITBG) - The AMC/TRADOC Artificial Intelligence (AI) Technology Base Group, chaired by LABCOM (HDL) will assist in requirements development and AI technology applications for AFV. The AITBG will review the ACRMP for AI technical management technique completeness.

3.3.31.6 Other Working Groups, Committees and Management Boards Numerous working groups, committees, and management boards exist throughout the Army. These groups are required to review their mission or charter for AFV applicability and report their findings to the AFV Task Force.

3.3.32 Army Program Executive Officers/Programs (PEO) - It is anticipated that PEO and associated Project Management (PM) organizations will play a vital role in AFV development. The Technology Assessment (first published, Feb 87 and provided to AMC) determined a myriad of automation and communication systems under PEO development, at or near fielding or undergoing preplanned product improvements are applicable to AFV. Many have direct application or interface with the AFV program. The Task Force goal is to maximize integration. Figure 3-6 lists the candidate applicable offices. General PM or PO integration responsibilities include but are not limited to:

A. TRADOC System Manager coordination in AFV matters.

B. Provide AFV Task Force system, subsystem or component milestone information.

C. Furnish results of technical demonstrations and other test in support of the AFV Concept Exploration and Demonstration Validation Phase.

D. Update PM or Project Office (PO) plans to support AFV schedules. Recommends AFV milestone changes or improvements.

E. Review AFV program management documentation to include the ACRMP for completeness.

F. Support the Task Force ongoing Technology Assessment efforts. Identify critical issues and preplanned product improvements (P3I).

G. Update communication and automated system resource management plans to ensure planning interface with AFV.

H. Provide technical assistance to the Automation and Communication Resource Working Group (ACRWG).

I. Provide technical data and specification concerning: size, weight, power, and operational considerations for tactical vehicle integration efforts.

J. Define current system, current and projected capability to interface, and interconnect with a vehicle or chassis common data, power, voice or video bus architecture.

K. Share lessons learned in support of AFV cost avoidance efforts.

PEO organizations which are applicable to AFV follow (detail are to be refined in future updates). Figure 3-4 denotes project management organizations (PMO) which have probable application. PEO and PMO responsibilities, in general, will be refined in subsequent ACRMP updates.

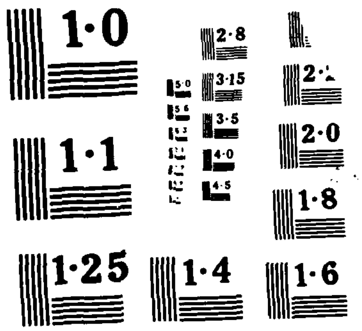
- HAWK
- PATRIOT
- STINGER
- AMMUNITION LOGISTICS (AMMOLOG)
- BORESIGHT DEVICES
- CLOTHING AND INDIVIDUAL EQUIPMENT
- BRADLEY FIGHTING VEHICLE SYSTEMS
- M9 ARMORED COMBAT EARTHMOVER (ACE)
- M113 FAMILY OF VEHICLES
- MINES, COUNTERMINES AND DEMOLITIONS
- MOBILE ELECTRIC POWER (MEP)
- MORTAR SYSTEMS (PROVISIONAL)
- MULTIPLE LAUNCH ROCKET SYSTEM (MLRS)
- NIGHT VISION DEVICES
- SATELLITE COMMUNICATIONS
- SMOKE/OBSCURANTS
- TACTICAL AIRBORNE REMOTELY PILOTED VEHICLE/DRONE SYSTEM (RPV)
- COMMERCIAL CONSTRUCTION EQUIPMENT AND SELECTED MATERIALS HANDLING EQUIPMENT (CCE/SMHE)
- TANK SYSTEMS
- M1 ABRAMS TANK SYSTEM
- TANK MAIN ARMAMENT SYSTEMS (TMAS)
- M1A1 ABRAMS TANK
- M60 TANKS
- TEST, MEASUREMENT AND DIAGNOSTIC EQUIPMENT (TMDE)
- TOPOGRAPHIC SUPPORT SYSTEMS
- TRAINING DEVICES (TRADE)
- ARMOR TRAINING DEVICES (ARD)
- ARMY COMMUNICATIVE SYSTEMS
- NUCLEAR, BIOLOGICAL, CHEMICAL (NBC) PROTECTION FOR COMBAT VEHICLES AND CREWS

Project Management Organizations
Figure 3-4

3.3.32.1 PEO Command and Control Systems (CCS) - PEO CCS designates [illegible] member to the AFV Automation and Communication Resource Working [illegible] (ACRWG). Integrates the AFV Battalion and Below Command and (B2C2) into the Army Tactical Command and Control System [illegible] under program managers (PM) listed in the figure below [illegible] applicability to AFV C3I Architecture development

AD-A190 934 ARMORED FAMILY OF VEHICLES (AFV) AUTOMATION AND COMMUNICATION RESOURCE MA..(U) ARMORED FAMILY OF VEHICLES TASK FORCE FORT EUSTIS VA R D BUCKSTAD 2/4

UNCLASSIFIED 01 SEP 87 F/G 5/1 NL


1·0
2·8
3·15
3·5
4·0
4·5
2·0
1·1
1·8
1·25
1·4
1·6

OPERATIONAL TACTICAL DATA SYSTEMS (OPTADS)
ADVANCE FIELD ARTILLERY TACTICAL DATA SYSTEM (AFATDS)
COMBAT SERVICE SUPPORT CONTROL SYSTEM (CSSCS)
FORWARD AREA AIR DEFENSE COMMAND CONTROL (FAADC2)
JOINT TACTICAL FUSION (JTF)/ALL SOURCE ANALYSIS SYSTEM (ASAS)
COMMON HARDWARE/SOFTWARE SYSTEMS

PEO CCS Program Managers
Figure 3-5

3.3.32.2 PEO Communications (PEO COMM) - PEO COMM designates a member to the ACRWG. A communications capability is a common AFV requirement. Three of the five projects (MSE, SINCGARS, ADDS/PLRS) have direct applicability to AFV. SATCOM applicability is pending AFV requirements refinement. MSCS is applicable for Corps and above echelons.

MOBILE SUBSCRIBER EQUIPMENT (MSE)[1]
SINGLE CHANNEL GROUND & AIRBORNE RADIO SYSTEM (SINCGARS)[1]
ARMY DATA DISTRIBUTION SYSTEM (ADDS)/POSITION LOCATION REPORTING SYSTEM (PLRS) [1]
SATELITE COMMUNICATIONS (SATCOM)[2]
MULTI-SERVICE COMMUNICATIONS SYSTEMS (MSCS)[2]

[1] - Direct Applicability
[2] - Direct Applicability to be Determined

PEO COMM Program Managers
Figure 3-6

3.3.32.3 PEO Intelligence and Electronic Warfare (PEO IEW) - Coordinates with PEO CCS and PEO COMM on AFV C3I Architecture (B2C2 & VCOS) matters. Figure 3 8 briefly lists systems which may have AFV direct applicability.

GUARDRAIL	MVD
TRAILBLAZER	FIRE FINDER
JSTARS	FAAD SENSORS
QUICKFIX	TACJAM
REMBASS	TEAMPACK

PEO IEW Program Managers
Figure 3-7

3.3.32.4 PEO Standard Army Multicommand Management Information Systems (PEO STAMMIS) - As B2C2 and ATCCS matures it is anticipated that direct inkages will be established with Army STAMMIS to reduce soldier workloads.

RETAIL LOGISTICS SYSTEMS
PERSONNEL SYSTEMS
MEDICAL SYSTEMS
TACMIS (HARDWARE)

PEO STAMMIS Program Managers
Figure 3-8

3.3.32.5 PM Combat Identification Systems (PM CIS) - PM CIS support of AFV is projected to include identification of technologies in the areas of target acquisition and evolutionary or incremental CIS.

3.3.32.6 thru 3.3.32.15 - Reserved for future use. The figure below briefly describes anticipated usage.

PEO	PROJECTED AFV SUPPORT
HEALTH CARE SYSTEMS	COMBAT MEDICAL SYSTEMS.
PM LHX	TECHNOLOGY.
ARMAMENTS	ARTILLERY & MORTAR FIRE CONTROL.
CLOSE COMBAT MISSILES	TOW FIRE CONTROL.
FIRE SUPPORT	MLRS & ATACMS FIRE CONTROL.
FORWARD AREA DEFENSE	RPV & UAV OPERATIONAL CONTROL, FAAD VEHICLE CONTROL.
TROOP SUPPORT	MOBILE ELECTRIC POWER.
CHEMICAL	NBC DEFENSIVE MEASURES.
CLOSE COMBAT VEHICLES	INTEGRATION AND TRANSITION.

PEO Support Pending Coordination
Figure 3-9

3.3.33 Department of the Army or Special Project/System Offices. It is anticipated that responsibilities will be the same as outlined in paragraph 3.3.32.

3.3.33.1 Classified Programs - Offices concerned with highly classified projects related to combat identification, tactical communications, command and control (C2), artificial intelligence, robotics, and tactical vehicle electronics are responsible for maintaining contact with the Task Force. Program applicability to AFV must be determined. Task Force personnel have prerequisite security clearances.

3.3.33.2 Reserved Future Use.

3.4 AFV SYSTEM DEVELOPMENT PHILOSOPHY - The development of automation and communication resource items will be in accordance with the basic requirements of AFV in the Justification of Major System New Start (JMSNS), Operational and Organization Plan (O&O), the evolving Required Operational Capability (ROC), and other appropriate requirements

documents. The Mission Equipment Package (MEP) and associated hardware/software for the AFV will be furnished in accordance with AFV design to meet overall system architecture requirements. Automation and communication requirements and developments will be treated as an integral part of the AFV life cycle.

3.5 STAFFING REQUIREMENTS - The AFV system integrator (pending or TBD), contractors, and supporting government agencies will provide the necessary staff for requirements development, analysis, design, development, test, maintenance, and support of the computer resources during the AFV Life Cycle. Verification and validation of the operational computer resources will be performed by the system integrator and the government. Independent verification and validation will be performed by the government or designated government agent independent of, and not affiliated with, the contractor developing the AFV computer resources.

3.6 INTEGRATION RESPONSIBILITY - The Director, AFVTF has overall responsibility for managing the integration of the automation and communication resources into the operational system environment. The ACRWG will be the Director's action team (Figure 3-2). CECOM is the planned lead C4 integrator and TACOM is the VCOS integrator. CACDA will integrate C4 and vehicle control combat development requirements. All lead AFV integrating centers will establish program management controls.

3.7 DEVELOPMENT OBJECTIVES - Definition of requirements, development approach, audits, testing, and maintenance of newly developed and modification efforts for communication and computer resources will be accomplished according to the objectives outlined below. During the accomplishment of these objectives, it will be necessary to identify the extent to which existing systems and equipments and process concepts will be used. An evaluation of the systems capacity for growth is also

required. Additionally, identification of projected computer equipment and computer program development costs, including the the appropriate work breakdown structures, will be necessary. The sources of this information will be the Request for Proposal (RFP), specifications, and other development program documents. As these documents evolve, specific information will be extracted and included in the ACRMP during subsequent updates. Detailed implementation of the objectives are contained in the Chapters which follow.

3.7.1 Requirements Definition - The requirements of the system will be defined in the AFV Requirements Document. These requirements will be reflected in appropriate Development and Product Specifications and the Test Procedures. The developers (contractor or government) will maintain traceability of the requirements throughout the design phases of AFV. Developers must utilize approved Requirements Engineering Methodology tied to a work breakdown structure to demonstrate the trail of a requirement from the System Specification to a specific test result.

3.7.1.1 Concept Exploration Phase - AFV requirements will be fully defined during concept exploration. The approved (June '87) Operational and Organizational (O&O) Plan and evolving Required Operational Capabilities (ROC) directly and indirectly require a myriad of automation and communication system resources to support AFV operations. Although concept exploration may be seen as a combat developer lead action, cost effective integration requires a combat and materiel developer team. Therefore TRADOC and AMC will be involved in the concept formulation process.

3.7.1.2 Demonstration and Validation - Requirements will be refined during this phase. Details are to be provided during a subsequent ACRMP update.

3.7.1.3 Full Scale Development - Paragraph is to be developed.

3.7.1.4 Production and Deployment - User requirements updates will be handled through life cycle activities. Further details are to be provided at a later date.

3.7.2 Development Philosophy - The development of computer resources software, which includes; analysis, design, coding, fabrication, and unit testing, integration testing, Software Configuration Item (SCI) testing, system integration and testing, and operational testing and evaluation, Hardware Configuration Item (HCI) testing, will follow the procedures outlined in the (to be developed) Hardware and Software Development Plan (H&SDP). Resource development will use the top down design approach as stated in DOD-STD-2167. Development support documentation will be maintained by the system integrator in accordance with the same standard (DOD-STD-2167) and will be provided to the AFV Director for review and comment during all developmental phases. The AFV Director will monitor software development effort during Demonstration and Validation and follow on phases by the means of informal and formal technical reviews. During Production the AFVTF will monitor and control the development effort by using formal reviews, audits, and data deliverables as set forth in the production contract.

3.7.3 Audits and Controls - Informal and formal reviews may be specified and used by the government for management of hardware and software development. Informal and formal reviews are discussed in Chapter 5.3.2 and descriptions of these reviews are included at Appendix I.

3.7.4 Test and Evaluation - The testing of computer resources will follow the procedures outlined in the Test and Evaluation Master Plan (TEMP) and supporting test documentation. A TIWG is established to coordinate

government and contractor test activities to assure that Development and Operational Test and Evaluation of the system is successfully accomplished. Refer to Chapter 6, Test and Evaluation.

3.7.5 AFV Hardware and Software Maintenance - The AFV hardware (to include communications) and software reconfiguration for systems prior to fielding (pre-deployment), during deployment and Post deployment are discussed in Chapter Seven, Plan for Support.

3.8 STANDARDIZATION AND PROVEN APPROACH

3.8.1 Software Standardization - AFV design planning stresses a modular and multimission capability hardware and software approach. The software development effort will use the Ada High Order Language (HOL) in accordance with DOD Instruction 5000.31. Exceptions if required must be approved and will be based on performance, testability, maintainability, and program management improvement. Request for waivers will be processed thru respective chains of command and must be in compliance with DODD-3405.2

3.8.2 Communication Standardization - To be determined based on CECOM recommendations.

3.8.3 Computer Hardware Standardization - To be determined.

3.9 DEVELOPMENT SUPPORT REQUIREMENTS

3.9.1 Software Support Facilities - After concept exploration, the system integrator will facilitate the development of the Life Cycle Engineering Center (LCEC) for the AFVTF. The software, firmware, and microcode developers will utilize an integrated software development station for the

development of all AFV required application software developed. Coordination between the AFV software support facilities and the LCEC is critical to ensure adequate post-deployment software support. During future update cycles, the ACRMP will be expanded to identify specific AFV software support facility requirements as they are identified and defined. LCEC implementation plans must be finalized before Milestone III. It is anticipated that there will be at least two LCEC's, in direct support of AFV, one for B2C2 and one for the VCOC. If hardware support is separated from hardware, then software developers will have hardware experienced staff.

3.9.2 Computer Hardware Support Facilities - To be determined, based on CECOM recommendations.

3.9.3 Communication Equipment Support Facilities - To be determined.

3.9.4 Government Furnished Equipment (GFE) - Figure 3-12 lists the candidate Government Furnished Equipment that will be available for development of AFV automation and communications resources.

3.10 SUPPORT EQUIPMENT - In producing the computer programs for the system, the developers (contractor or Government) will very likely use special programs, tools, and facilities which will be used throughout the AFV life cycle for support of AFV automation and communications resources. The support equipment planned for AFV will be consistent with the approach taken by the Government for AFV software Life Cycle Software Support (LCSS). The system integrator will have overall responsibility for software integration. The software development suite developed in accordance with DOD-STD-2467 (AR) at the prime contractor facilities will be transitioned to the AFVTF designated LCEC. The LCEC will ensure support of the fielded AFV software. Plans for transition of post

AFVTF Organization for Hardware/Software Management

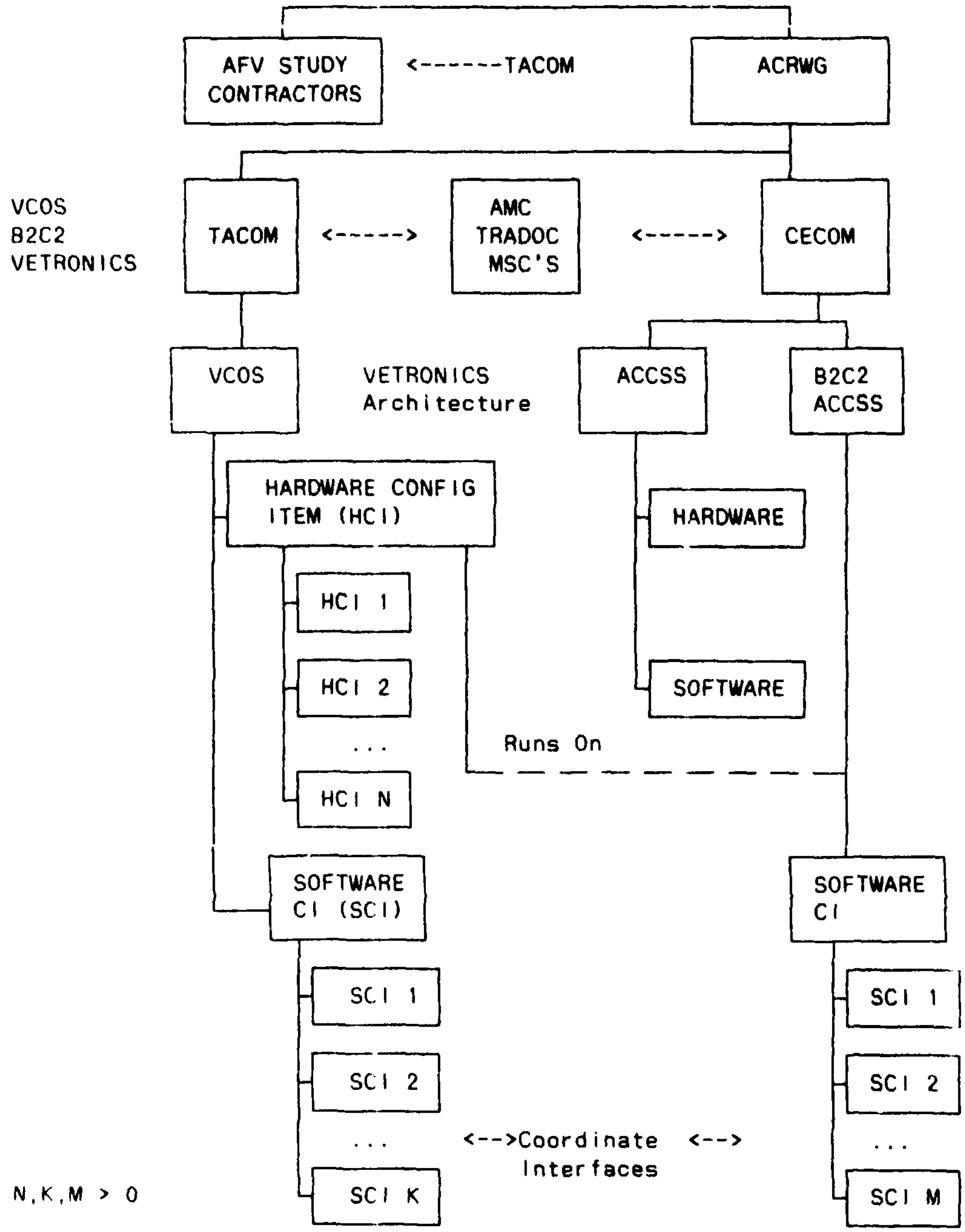


Figure 3-10

deployment AFV software support from system integrator to Government LCEC will be determined at a later date.

3.11 DEVELOPMENT RISK ASSESSMENT - Computer resource requirements shall be continuously coordinated and reconciled with system operational requirements throughout the AFV system life cycle. Resource requirements, security issues, interface control, and integration methodology will be reviewed as necessary. Assessments shall be performed before Milestone I and II to identify risk areas involving automation and communication resources. The risk areas and the plan for minimizing risk consistent with stated operational requirements shall be identified in the acquisition decision documentation at the Milestone I/II review. Design and trade-off studies will be conducted as necessary to evaluate potential risk areas. Risk areas requiring special monitoring will be identified and procedures for monitoring and assessing the risk will be implemented. Currently identified areas of concern are shown in Figure 3-2.

3.12 SUMMARY, PROGRAM MANAGEMENT - Chapter 3 specifies management resources and organization needed to accomplish the development, integration, and support of AFV automation and communication resources. The risk involved in the development of these resources is also discussed. Figure 3-12 depicts a brief milestone summary.

Table of Government Furnished Software (GFS)
and Government Furnished Equipment (GFE)

Equipment	Agency
o Maneuver Control System (MCS)	PEO CCS
o All source Analysis System (ASAS)	PEO CCS/IEW
o Forward Area Air Defense Command, Control, Intelligence System (FAADC2I)	PEO CCS
o Advanced Field Artillery Tactical Data System (AFATDS)	
o Combat Service Support Control System (CSSCS)	LOGCEN/PEO CCS
o Single Channel Ground Radio System (SINCGARS)	PEO COMM
o Mobile Subscriber Equipment (MSE)	PEO COMM
o Enhanced PLRS User Unit (EPUU)	PEO COMM
o Vehicle Navigation Azimuth System (VNAS)	ARDEC
o Module Azimuth Positioning System (MAPS)	ARDEC
o ACCS Common Hardware (when available)	PEO CCS
o Flat Panel Displays	ETDL
o Digital Data Entry Devices	ETDL
Publications	AMC/TRADOC
References	AMC/TRADOC
Specifications	
Topographic Data Base Standard	ETL
Built In Test Output Standard	CECOM
Vehicle Electronic Data Bus Standard	TACOM
Common Graphic Symbology Standard	CACDA
Driver Station Standard	CACDA
Vehicle Commander Station Standard	CACDA
ACCS System Specification	PEO CCS
B2C2 User Definition	CACDA
VCOS User Definition	CACDA
Software Tools	
Topographic Software	To Be Determined
Vehicle Integrated Intelligence	To Be Determined
BMS (as developed to-date)	To Be Determined

Figure 3-11

C4

MAJOR MILESTONES

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                                   86  87  88  89  90  91  92  93  94  95 ...

VCOS TACOM/CACDA                      =  ===============<>
VCOS AFV STUDY CONTRACTOR - 1  <>================<>
VCOS AFV STUDY CONTRACTOR - 2  <>================<>
VCOS AFV STUDY CONTRACTOR - 3  <>================<>
B2C2 CECOM/CACDA                         ==========<>
B2C2 AFV STUDY CONTRACTOR - 1  <>================<>
B2C2 AFV STUDY CONTRACTOR - 2  <>================<>
B2C2 AFV STUDY CONTRACTOR - 3  <>================<>
AFVTF/PEO SELECTS BEST VCOS/B2C2                  <>
AFV VCOS DEVELOPMENT                              <>==================<>
AFV B2C2 DEVELOPMENT                              <>==================<>
FIELD                                                                     <>
```

Figure 3-12

CHAPTER 4 - ACQUISITION MANAGEMENT

4.1 INTRODUCTION

This Chapter of the CRMP addresses the acquisition strategy that will be followed throughout the development, acquisition, testing, and fielding of the AFV computer resource items. A description is given of the system engineering approach to allocating operational needs to computer resources and critical design areas. Organizational responsibilities and roles of the program participants, and the acquisition process together with deliverables and post-deployment support considerations are also discussed. Operational and support concepts are addressed in Chapter 6, Plan for Support. Review Chapter 1 for the overall acquisition concept.

4.1.1 Acquisition Strategy

The acquisition strategy of AFV is straight forward. After successful completion of Milestone I/II in 1989 the Director, AFVTF will release a Request For Proposal (RFP) for the AFV Development/Prove Out (DPO). The DPO will be carried out as discussed in Chapter 3 of this CRMP. Following a successful Milestone III, the Production and Deployment Phase of the AFV program will commence. The AFV will be developed as a total system.

AFVTF, in collaboration with other cognizant agencies, will provide the following computer resource inputs to the procurement package: performance requirements (specifications), proposal preparation instructions (instructions to bidders), contract tasks (SOW and WBS), deliverable items (contract schedule and contract data requirements list (CDRL)), and special provisions. AFVTF will determine the need for and develop the types of special contract provisions as specified below.

4.1.1.1 <u>Computer Development Contraints</u> - When constraints, such as High Order Languages (HOLs), spare memory and throughput requirements, security requirements, bus interfaces and interconnection, interoperability, and software interservicing requirements, are part of the computer software development effort, applicable provisions shall be clearly stated in the SOW and specification.

4.1.1.2 <u>Communication Development Constraints</u> - Similiarly, any constraints to the development of communications hardware and software will be specified in the SOW and in the Specifications for the communications hardware or software.

4.1.1.3 <u>Access to Internal Contract or Data</u> - An enabling clause shall be included in the contract(s) to provide the Government and its authorized agents access to contractor internal AFV design and development documentation during all phases of the FSD program.

4.1.2.4 <u>Commercial Computers and Software</u>. - Procedures will be developed and incorporated into the contract to ensure that the contractor reviews and documents all subcontractor or vendor changes and that all commercial hardware and software in the system is maintained to the correct performance and configuration level. The contractor will be made

responsible for maintaining engineering compatibility between all system equipment and software, including incorporation of newly released versions of software until specifically released by the government.

4.1.1.5 Support Software Deliverables. - Support software required to cost-effectively develop and maintain the delivered computer resources over the system life cycle shall be specified as deliverable; witn the provisions for DOD acquiring appropriate rights to its design and use. Examples of support software include, but are not limited to, operating systems, compilers, source and object code for development tools, test drivers, programs and tools, environmental simulators and analyzers, and training aids.

4.1.1.6 Rights to Computer and Communication Resources Software. - Contractual provisions shall reflect the Government's requirements for unlimited rights to the computer and communciation resources software and associated documentation. (See paragraph 4.6, Computer Program and Data Rights).

4.1.1.7 Subcontract Management. - Computer resources (including computer software) may be developed under a subcontract to a prime contractor, therefore the prime contract must be written to ensure that all appropriate contractual requirements levied on the prime contractor are

passed to all subcontractors. The prime contract will ensure that the subcontractors are responsible for the integrity of their products and identifies the prime contractor as responsible for the ultimate delivery and integrity of all system products. AFVTF reserves the right to coordinate directly with subcontractors.

4.1.1.8 Tailoring. - General system (hardware/software) engineering development methods will be tailored to support the AFV Acquisition Schedule. Engineering development phases will not likely require planned overlap or parallel execution. The AFVTF or designated representative will evaluate applicable military standards for computer resource development and identify tailoring required to appropriately adapt the computer software development cycle to reflect AFV system acquisition needs. AFVTF will perform a similar tailoring of the data item descriptions for software development products. In addition, AFVTF will determine which of the software documents are needed by using DOD-STD-2167, and identify them as deliverables if appropriate. In making these assessments, AFVTF will have primary consideration to the need for such documents during the particular program phase and within the context of system use and support throughout the system life cycle. Consideration will be given as to the optimum time for delivery or procurement of necessary software documentation such that the documentation is not subject to massive change.

4.2. ACQUISITION MANAGEMENT ORGANIZATION AND RESPONSIBILITIES

During the acquisition phase, participants identified in Chapter 3 will assume a more active role as described in the following paragraphs.

4.2.1 Government Organization

The Director, AFVTF has overall responsibility for planning, directing, and controlling the acquisition of the program and ensuring that the requirements of the JMSNS, ROC etc. are met. The Director will manage the acquisition in accordance with the program schedule and goals, ensuring that each phase of the program yields the results necessary to support the Milestone decision process.

4.2.1.1 Program Management Support - An Automation and Communication Resources Working Group (ACRWG) will be established to aid in the management of the AFV computer resources acquisition. The ACRWG will perform reviews and analyses in accordance with its charter and in response to tasking by the Director, AFVTF.

4.2.1.2 ACRWG Functions - The ACRWG shall assist in ensuring that automation and and communications resources comply with established policy, procedures, plans, and standards. The ACRWG shall continually support the AFVTF in computer resource life cycle planning. The ACRWG recommends updates to the CRMP, to ensure that acquisition, user, and support requirements are satisfied. The ACRWG evaluates computer software plans, products, and proposed changes to ensure compatibility with accepted policies and procedures. The ACRWG also supports AFVTF in the resolution of issues such as documentation requirements, communications, and support agreements. Special roles that the individual participants will assume during acquisition will be assigned and determined by the ACRWG Chair and reflected in ACRWG meeting minutes. The ACRWG will require the system integrator to report the contractor computer resources acquisition management organization and will incorporate that organization into the CRMP following award of Development Proveout and Production/Deployment phase contracts.

4.2.1.3 Army Materiel Command (AMC)

4.2.1.4 Training and Doctrine Command (TRADOC)

4.2.1.5 Program Executive Offices

4.2.1.6 Program Managers

4.2.2 Contractor Organization

Review Contractor organizations in Chapter 1.

4.3 AUTOMATION AND COMMUNICATION ARCHITECTURE, RESOURCE ALLOCATION

The criteria and constraints to which the system architecture must be responsive will be specified. It is planned that the specifications for automation and communications resources will mature during Development/Prove Out. Emphasis will be placed on top-down design and the structuring of hardware and software modules. Configuration factors which may impact the architecture such as a networking of processors, distributed processing, real-time processing, man-machine interface, communication processing fail-soft or graceful degradation configuration will be specified by the government prior to DPO phase. Review Chapter 2, Requirements Analysis for the architecture definition.

4.4 SYSTEMS ENGINEERING APPROACH

The basic requirement is that the AFV developers deliver final products in the approved configuration. Strict adherence to currently accepted system engineering methodology will ensure that the AFV computer resources possess the required high degree of reliability/maturity, availability, and maintainability required. Tailoring the engineering cycle (paragraph 4.1) must not alter this requirement.

4.4.1 Requirements Allocation

Management control must be employed to ensure that the system requirements are properly allocated to the system hardware and software. This may involve invoking a requirements engineering methodology to assure traceability of requirements in the specifications, test procedures, and other system documents.

4.4.2 Development Methodology

Special software development requirements for the AFV are discussed in Chapter 5. These include the use of Ada, the construction and use of a system prototype, and the early establishment and operation of the LCSEC's. Any other special requirements that will be levied on development contractors, such as the use of a program design language (PDL), structured testing, test case generation, simulation, etc., will be specified in Development Prove Out (DPO) and Production/Deployment RFP's.

4.5 HARDWARE/SOFTWARE TRADE-OFFS

Hardware/software tradeoff analyses are performed to determine the best balance among system performance characteristics, support resource requirements, and support concepts. The principles of Integrated Logistic Support (ILS) are applied to both hardware and software as a part of each tradeoff analysis. This includes analyses for training and diagnostic equipment. The analyses performed will include consideration of the effects of the software design and post-development software software change fielding methodology on overall AFV system and subsystem Reliability, Availability, and Maintainability (RAM). Particular emphasis will be placed on identifying and including in the logistic analyses, the full or partial loss of required operational capabilities as they are affected by the amount of time and quantity of resources needed to distribute and install software changes worldwide to AFV systems and support equipment. The time and effort needed to develop and field the software improvements identified by programs such as MANPRINT will also be considered. The results of the software analyses will be merged with those from the hardware analyses to determine assembly, module, and system RAM.

Based on previous experience with functionally similiar software, the combat developer with assistance from the materiel developer, will establish an expected frequency for fielding post-development software changes. This frequency, i.e., the Mean Time Between Maintenance (MTBM), will be utilized in determining the life cycle cost in any tradeoff analysis used to determine whether to implement a function in hardware, software, or firmware. For the purpose of fielding software changes, the Mean Time To Repair (MTTR) a hardware assembly containing the software will be taken as the hands-on time required to gain access to the hardware containing the software, swap out the hardware or load new software into the existing hardware devices(s), reassemble, and test the system to verify proper operation of hardware and software.

The effects of post-development fielding of software changes on life cycle cost will also be considered in establishing the design of all new hardware, in selecting existing hardware for inclusion in the production system, and in determining the level of system readiness provided. Primary design goals will include the minimizing of spares required to field a software change, minimizing or eliminating the cost of purging obsolete software from the supply system, and utilizing the on-site organizational maintenance personnel to install software changes. Any decision to use firmware and all hardware/software tradeoff decisions will be supported by a life cycle cost analysis demonstrating that the decision results in the lowest life cycle cost for providing the required capability.

4.5.1 Software Acquisition

Software requirements will dictate the acquisition of hardware components and firmware. Software will be acquired and used to implement complex functions with a high probability of change

4.5.2 Hardware Acquisition

Hardware acquisition is favored for the implementation of simple, iterative tasks with a low probability of change.

4.5.3 Firmware Acquisition

The combination of associated computer instructions and computer data definitions required to enable the computer hardware to perform computational or control functions is defined as computer "software". The definition of software is independent of the medium on which the software resides. Computer instructions and data that reside as read-only information on a hardware device, i.e., "firmware", will be considered software. Firmware will be developed, managed, and documented as software. Firmware development equipment, read-only memory programming equipment, and read-only memory devices will be managed and documented as hardware.

4.5.4 Communication System Acquisition

4.6 STANDARDIZATION AND COMMONALITY

Standardization (review para 3.8, standardization and proven approach) and commonality considerations are the major factors in reducing the risks associated with the acquisition of the AFV. These factors reduce the risk and cost associated with new products, provide a base of experience, and reduce logistics concerns. Examples of AFV commonality and standardization considerations are reflected in the following common requirements:

- Ada Programming Language
- Standard Data Bus Networks and Interconnections
- Standardized Instruction Set Architecture Hardware
- Displays (Fighting Stations)
- Vehicle Control
- Diagnostics Modules (with built in test)
- Prognostics Modules
- Embedded Training Modules
- Communication Systems and Control Module
- Graphics Support Module
- Intercom
- Environment Control
- Power Interface(s)
- Test Measurement Diagnostic Equipment
- Automatic Logbook

4.7 COMPUTER PROGRAM AND DATA RIGHTS

The Government will have unlimited rights to communication and computer programs and data required in the acquisition and life cycle support of the AFV. Any exception must be approved by the Government in accordance with DOD-STD-1467/1479. These rights will include the right to use, modify, combine, reproduce, and distribute all computer programs and associated documentation necessary to the support concept stated in this CRMP.

4.8 MASTER ACQUISITION SCHEDULE

The acquisition schedule for the AFV is shown in Figure 4-1. Milestones, events, and actions which are key to the timely development of the AFV computer resources are shown in Figure 4-2 in the context of the overall acquisition schedule and specifically detailed in the AFV FSD proposal. These schedules will be reviewed, updated, and reflected as revisions to the CRMP during the life of this program.

4.9 AFV INTERFACES

AFV interfaces can be divided into two basic categories: internal and external. The internal interfaces are comprised of the vehicle automation, communication, and electronic architecture components. The external interfaces are comprised of off-carriage command, control, communication, and TMDE systems.

4.9.1 Internal Interfaces

4.9.2 External Interfaces

4.10 GROWTH REQUIREMENTS

The AFV developers will be required to design software and selected hardware that incorporates features for future growth capability, modularity, and ease of modification. The contractor will devise guidelines and methods to allow for ease of software revisions and maintenance. The AFVTF will ensure that software is designed in accordance with the Computer Software Development/Design Specification(s) through both formal and informal review procedures.

4.10.1 Memory Growth Requirements

4.10.2 Processing Capacity

4.10.3 Input/Output Capacity

4.10.4 Data Bus Growth

The bus architecture is designed to support modular systems.

4.10.5 Communication System Growth

4.11 DOCUMENTATION ACQUISITION

The documentation requirements for the acquisition and support of the AFV computer resources will be specified in RFP's prior to award of Development Proveout and Production/Deployment (or FSD) phase contracts. The ACRWG will include those specifications in a planned revision of the CRMP. As a minimum user documentation will be developed concurrently with hardware and software. It is envisioned that technical bulletins, user, and command/staff guides will be created. Documentation medium (paper, visual display) has yet to be determined.

Armored Family of Vehicles (AFV)
Acquisition Schedule

87 88 89 90 91 92 93 94 95 96 97 98 99 00 01 02 03 04 05 06
Jan
5 4 3 2 2 2 4 4 3 2 2 2 4 4 2 2 2 2 4 3

	Who	Status
POP TASK FORCE EFFORT	AFVTF	C
POP TECHNOLOGY ASSESSMENT	AFVTF	
POP AFV CONTRACTOR EFFORTS	TACOM, AFVTF	
POP DRAFT INT LOG SPT PLAN	AFVTF	
POP PRELIM CRMP PRODUCT	AFVTF	
POP BTA/COEA AFV PRODUCT	AFVTF	
POP DFT TEMP	AFVTF	
POP DFT MANPRINT MMP	AFVTF	
MS STAR REVIEW	HQDA	
POP TECHNOLOGY ASSESSMENT	AMC.HQDA.TRAD+	
POP CRITICAL TECH DEMOS	AMC, TRADOC	C
POP EARLY USER TEST & EVAL	AMC, TRADOC	C
POP PROOF OF PRINCIPLE	AMC	C
POP DATA COLLECTION	AMC, TRADOC	pC
PEO AFV	AFVTF	C
PEO SYS ENG CONTRACTOR	PEOCONTR	pC
POP UPDATE PROG MGMT PLANG	HQDA.PEOAFV,T+	C
MS DECIDE 1-2 K'S FOR DPO	HQDA, PEOAFV	p
MS I/II	HQDA	pp
DPO DEVELOPMENT PROVEOUT (	PEOAFV	C
DPO TECH DEMOS FOR P3I CAN	AMC.TRADOC.HQ+	
POP TECHNOLOGY ASSESSMENT	AMC.TRADOC,HQ+	p
DPO DEV CONTRACT AWARDS	AMC, PEOAFV	pp
DPO DES/FAB HDW PROTOTYPES	PEOAFV, CONTR	
DPO CONTRACTOR TESTING	CONTR	p
DPO CONTINOUS TEST & EVAL	AMC,TRADOC,CO+	C
DPO TECH TEST & EVAL	AMC	p
DPO USER TEST & EVAL	TRADOC	p
PD LONG LEAD ITEM	PEOAFV	C
DPO UPDATE PROG MGMT PLANS	HQDA.PEOAFV,T+	C
MS III	HQDA	pp
PD PRODUCTION & DEPLOYMENT	PEOAFV	
POP TECHNOLOGY ASSESSMENT	AMC.TRADOC.HQ+	p
PD INITIAL PROD CONTRACT	AMC	
PD INTIAL PRODUCTION PHASE	CONTR	
PD TRAINING	TRADOC, CONTR	pC
PD INTIAL AFV DELIVERIES	CONTR	pp
PD PROD QUALITY TEST	AMC	pC
D DEPLOYMENT START	HQDA	p
D DEPLOYMENT	PEOAFV, CONTR	C
D INIT OPER CAP (IOC)	FORSCOM.USAEU+	

D Done
C Critical
R Resource conflict
p Partial dependency
Scale: Each character equals 3 months

=== Task
+++ Started task
M Milestone

- Slack time (==—), or
Resource delay (—==)
> Conflict

Figure 4-1

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MAJOR MILESTONES

COMPUTER RESOURCES ACQUISITION

Timeline columns: 86 Jan, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 00, 01, 02, 03, 04, 05, 06 (counts: 2 5 4 3 2 2 2 4 4 3 2 2 2 4 4 2 2 2 2 4 3)

#	Task	Who	Status	Chart	Remarks
1	C2 AFVTF CHARTER & STAFFING	HQDA	D	==	C2: Charter for AFVTF signed by LTG VUONO 1986, AFVTF was
2	C2 VCDS DEVELOPMENT	CONTR	pC	+++++++++++++	C2 AFV Study Contractors effort to develop the VCDS or
3	C2 B2C2 DEVELOPMENT	CONTR	pC	+++++++++++++	C2 AFV Study Contractor effort to develop the B2C2 Sys.
4	C2 VCDS DEVELOPMENT-GOVT	AMC, TACOM	pC	++++++++++++	Vehicle Control & Operating System (VCOS) development. Will
5	C2 PRELIM CRMP DEVELOPMENT	AFVTF		+++	C2 Draft CRMP for AFV Star Review. Plans are to update.
6	C2 CRMP PRELIMINARY DUE	AFV C3I		6:M	Draft Computer Resource Mangagement Plan for AFV
7	C2 AFV CRMP DEVELOPMENT	AFV C3I, AMC	C	7:=========	C2 Develop Final Computer Resource Management Plan.
8	MS STAR REVIEW	HQDA		8:M	
9	C2 EARLY USER TEST VCDS/B2C2	AMC, TRADOC		9:======	C2: Early User Testing/ Continuous testing of B2C2, VCDS and
10	C2 COLL DPO TESTING ISSUES	AMC,TRADOC,AFV+	C	10:=======	C2: Collect DPO Critical Testing issues for C4, Robotics, VE
11	C2 COLL HUM FACTORS ISSUES	AMC,TRADOC,AFV+	C	11:=======	C2: Collect DPO Critical Issues regarding C4, VETRONICS,
12	C2 COLL ILS C4 ISSUES	AMC,TRADOC,AFV+	C	12:=======	C2: Collect DPO Critical Issues regarding C4, VETRONICS,
13	C2 COLL TRAINING ISSUES	AMC,TRADOC,AFV+	C	13:=======	C2: Collect DPO Critical Issues for C4, Robotics, VETRONICS,
14	C2 COLL CRIT C4 DPO ISSUES	AMC,TRADOC,AFV+	C	14:=======	C2: Collect DPO Critical Issues for C4, Robotics, VETRONICS,
15	C2 TECH ASSESS C4 & VCDS	AMC,HQDA,TRADO+		15:=========	C2: AFV Technology Assessment continious, search for P3I.
16	C2 TECH DEMOS CRITICAL C4	AMC, TRADOC	C	16:=========	C2: Monitor & Collect Critical Tech Demo results for B2C2,
17	C2 B2C2 DEVELOPMENT- GOVT	AMC, CECOM	C	17:=========	C2 B2C2 Development by government, candidate for P3I or as t
18	C2 ACCS AFV SPT PLAN	CECOM	p	18 M------	C2 CRMP Annexes are the Sigma Star Plans to incorporate AFV.
19	C2 B2C2 & VCDS DEMOS	AMC, CONTR	p	19 M--	C2 Demonstrations for B2C2 and VCDS Sys.
20	C2 AFV SOFTWARE SPECIFICATIO	PEOC3I, CAC	C	20 M	C2: AFV Software Specifications completed and for FSD de ing
21	C2 VCDS SELECTION	PEOC3I, CAC	C	21 M	C2: C2 VCDS- Vehicle Cons, select the best system.
22	C2 B2C2 SELECTION	PEOC3I, CAC	C	22 M	C2: C2 VETRONIC Architecture selection suppts the selection
23	C2 SELECT VETRONIC ARCHIT	PEOC3I, CAC	C	23 M	C2: VETRONIC Architecture selection, pick best VCDS.
24	C2 AFV CRMP FINAL	PEOC3I	pp	24 M	C2: AFV CRMP ready to start DPO, covers DPO & PD phases.
25	C2 VCDS CRMP DRAFT	AMC, CONTR	p	25 M	C2: Plan to manage the VCDS thru DPO and DP.
26	C2 B2C2 CRMP DRAFT	AMC, CONTR		26 M-	C2: B2C2 plan thru DPO and DP phases.
27	MS I/II	HQDA	pp	27 M	Milestone I/II to start Development ProveOut Phase.
28	C2 AFV B2C2 DEVELOP PROVEOUT	TBD-UNK		28 ============	The best 1 or 2 B2C2 systems will enter into the DPO Phase.
29	C2 AFV VCDS DEVELOP PROVEOUT	TBD-UNK		29 ============	C2: The best VCDS (w/ VETRONICS Arch) will proceed to DPO.
30	C2 TECH DEMO C4 P3I CAND.	AMC,TRADOC,HQD+		30 ===============	C2: TECH DEMOS to support P3I candidates POP. Potential for
31	C2 TECH ASSESS C4 CONTINUES	AMC,TRADOC,HQD+		31 ===============	C2: AFV Technology Assessment continious, search for P3I.
32	MS DECIDE 1-2 K'S FOR DPO	HQDA, PEOAFV	C	32 M	Decision: select one or two contractors to move into DPO.
33	DPO DEV CONTRACT AWARDS		pp	33 M	
34	C2 DRAFT TPS MGMT PLAN AVAIL	AMC,CECOM,CONT+		34 M--	C2 Test Program Set Mgmt Plan Available, interface TMDE
35	C2 EQUIPMENT TRAINING PLANS	TRADOC,AMC,CON+		35 M--	C2 New Equipment Training Plans including devices.
36	C2 ALL CRMP'S FINAL	AMC, PEOC3I	C	36 M	C2: VCDS, B2C2, AND ACCSS PLANS FINAL.
37	MS III	HQDA	p	37 M	
38	PD LONG LEAD ITEM	PEOAFV		38 M	PD: Indentify or Reexamine the Long Poles- Crt paths.
39	C2 FREEZE C4 BASELINE	PEOC3I,LCSEC B+		39 M	C2: Freeze hardware and software configuration for Prod Test
40	C2 B2C2 TRANS TO ACCS	CECOM	C	40 ========	C2: B2C2 becomes an ACCSS as an Army C2 system.
41	C2 TRANSITION TO LCSEC SUPPO	LCSEC VCDS,LCS+	C	41 ====	C2 Transition software engineering mgmt to Life Cycle SE Ctr
42	PD INITIAL PROD CONTRACT	AMC	C	42 M	
43	D DEPLOYMENT START	PEOAFV	pp	43 XM	
44	C2 PUBLISH TM'S & FM's	CONTR, TRADOC	C	44 =	C2: Publish tech & field manuals. Medium, to be determined.
45	C2 VCDS/B2C2 MAINT & P3I	LCSEC VCDS,LCS+		45 ================-------	C2: Life Cycle Software Eng Center support.
46	D INIT OPER CAP (IOC)	USAEUR, FORSCOM		46 M	
47	C2 VCDS/B2C2 SOFT CHG P3I	LCSEC B2C2,LCS+	p	47 ==----------	C2: First Change Package.

D Done — Task — Slack time (==---), or
C Critical +++ Started task Resource delay (---==)
Re[source] conflict M Milestone > Conflict
[Part]ial dependency
: Each character equals 3 months

Figure 4-2

4.11.1 Government Furnished Documentation

Government furnished acquisition and support documentation includes requirements documents and documentation for other Army systems with which the AFV must interface. This documentation establishes the functional and operational requirements for the AFV. The automation and communications resources functional and operational requirements will be developed from the acquisition documents and incorporated into a planned revision of the CRMP. Review Figure 3-4, Government Furnished Equipment and Software.

4.11.2 Contractor Provided Documentation

Contractor furnished documentation will be prepared and delivered in accordance with the Contract Data Requirements List (CDRL).

4.12 SUPPORT FACILITIES

4.12.1 Automation Support Facilities

Computer support facilities for AFV hardware and software resources support are introduced in Chapter 3 and discussed in Chapter 6.

4.12.2 Communication Support Facilities

4.12.3 Development Support Facilities

The system integrator will facilitate design and develop software development facilities needed for AFV software integration and testing. These facilities will include the Life Cycle Software Engineering Center or centers (LCSEC). During Development Proveout (DPO), the LCSEC will be used to

integrate and test software components. During Production/Deployment, the LCSEC, under direct control of the AFVTF, will be the focal point for maintenance of AFV automation and communications resources.

4.12.4 Deployment Support

Prior to deployment of the AFV the system integrator will pass control of the software development and support facilities to the AFVTF LCSEC.

4.12.5 Post Deployment Support

The AFVTF LCSEC will operate the software development and support facilities for post-deployment support of the AFV.

4.13 CONFIGURATION MANAGEMENT CONCEPTS

Configuration management of communication and computer resources for the AFV is described in Chapter 7 of the CRMP. Configuration management will be implemented by the system integrator under the supervision of the AFVTF ACRWG. During post-deployment of the AFV, configuration management will be accomplished by the AFV LCSEC under the supervision of the AFVTF.

4.14 TRANSFER AND TURNOVER

The responsibility for management of the support of computer resources for the AFV will pass from the contract integrator to the AFVTF LCSEC following deploym[illegible] the AFV.

4.15 SUMMARY, A[illegible]UISITION MANAGEMENT

Chapter 4 discu[illegible]ses the acquisition of automation and communications resources for the AFV. Review the AFV Acquisition Strategy and Integrated Logistics Support Plan, Volume III.

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CHAPTER 5 - DEVELOPMENT MANAGEMENT

5.1 INTRODUCTION

This Chapter addresses the management approach to be utilized during the development of AFV computer resources, the tools to be used, the necessary facilities, and the associated costs and schedules. The actions necessary for the development and delivery of specifications and the required support resources are also identified. The AFVTF management strategy during the computer resources development cycle within the AFV system Life Cycle is to maintain necessary visibility of the TRADOC, AMC, and contractor's managerial and technical activities, to apply management controls in a timely manner, and to ensure that system requirements are cost-effective.

5.2 DEVELOPMENT ORGANIZATIONS

Development of automation and communications resources for the AFV will require AFVTF management of development contractors and system integrators.

5.2.1 Armored Family of Vehicles Task Force (AFVTF)

The Director, AFVTF monitors the development process and has overall management authority for the design, test, integration, modification, and production of the AFV computer resources. The Director, AFVTF is supported by the Task Force staff, the US Army commands/agencies, and the Automation and Communications

Resources Working Group (ACRWG) identified in Chapter 3 of this CRMP.

5.2.2 Development Contractors

Contractor effort will be used for the design, testing, integration, documentation, and production of the AFV computer resource items. Figure 5-1 shows the planned structure of the system integrator AFV Computer Resources development organization.

5.2.3 System Integrator

The system integrator is responsible for verification, validation, and integration of communication and computer resource items into the AFV.

5.2.4 Army Materiel Command (AMC)

AMC will serve as the materiel developer for the AFV automation and communciations resources. Detailed repsonsibilities for AMC and subordinate commands are in Chapter 3. Close coordination with TRADOC users and testers and with the AFVTF will be required

5.2.5 Training and Doctrine Command (TRADOC)

TRADOC is the combat developer for the AFV automation and communications resources. Detailed responsibilities for TRADOC and subordinate activities are in Chapter 3. Close coordination with materiel developers and the AFVTF is required.

Contractor's AFV
Computer Resources
Development Organization

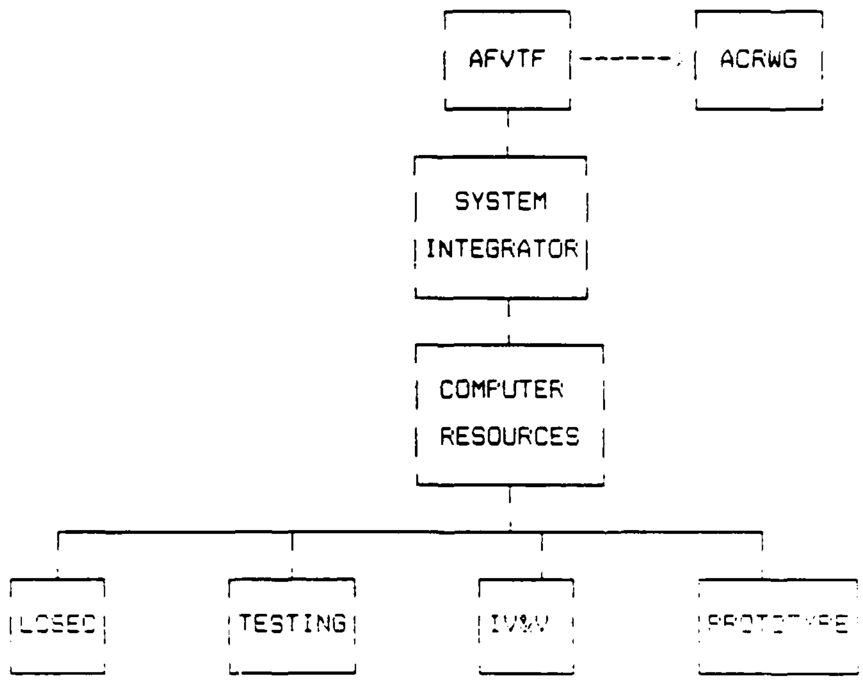

Figure 5-1

5.2.6 PM and PEO Organizations

5.3 TECHNICAL AND MANAGEMENT CONTROLS

The AFVTF will develop and apply the management and technical controls necessary to monitor software production by contractors. Traceability of requirements and periodic status reviews are primary controls to be used. The system integrator will be the central focal point for the management of software development. The system integrator will operate or coordinate with the LCSEC(s) during development and will accomplish systems level integration and testing. The AFVTF will conduct software development reviews at the system integrator's facilities.

5.3.1 Requirements Traceability

The traceability of requirements from the Required Operational Capability (ROC) to the System Specification, the Development Specifications, and the Product Specifications will be monitored by the AFVTF. The AFVTF will ensure traceability of requirements and will task appropriate Army agencies to review the specifications, test documentation (plans, procedures, and results), and source code. The system integrator will be responsible for the validation of computer resource items to requirements documents and for presentation of traceability analyses to the AFVTF for review.

5.3.2 Review and Audits

Government reviews of the software development effort will be required during Development Proveout and during Production/Deployment and will include review of specifications, interface control drawings, test and evaluation plans, test procedures, and test reports. Reviews will be conducted IAW MIL-STD-1521B and will ensure an orderly software development program. This, combined with the normal AFV program reviews and audits will provide the Director, AFVTF with visibility into the contractor's managerial and technical activities. Director, AFVTF will continually evaluate contractor performance, identify problem areas, and take corrective actions. Computer resource activities will accomplished in a logical and orderly manner consistent with contract requirements. Existing commercial off-the-shelf computer products will be considered for administration and non-tactical application if they contain the necessary performance and information required by the Contract Data Requirement List (CDRL). Government review of the contractor developed specifications will be conducted at designated major/minor contract milestones as specified in the Development Proveout (DPO) and Production/Deployment contract(s). The following informal and formal reviews may be specified and used by the government. Detailed descriptions of these reviews are included at Appendix I.

a. Informal Technical Reviews

- o System Requirements Review (SRR)
- o System Design Review (SDR)
- o Software Specification Review (SRR)
- o Preliminary Design Review (PDR)

B. Critical Design Review (CDR)

C. Formal Qualification Review (FQR)

D. Functional configuration Audit (FCA)

E. Physical Configuration Audit (PCA)

5.3.2.1 Development Planning and Controls - AFVTF will ensure that the contractor develops and maintains plans for software development which are in consonance with the Government's overall computer resource life cycle planning. The Development Activity will ensure that the contractor develops computer resource plans for software engineering management, configuration management, software quality, reliability, and maintainability, security, library, interfaces, data management, and system safety in accordance with the requirements of the SOW. The Development Activity will ensure that the contractor establishes and maintains management, financial, and technical controls to positively identify any deviations from plans. The Development Activity will track the contractor's utilization of computer resources to assure that the contractor complies with established margins for reserve capacity.

5.3.2.2 Status and Cost Reporting - AFVTF will ensure that the contractor maintains schedules, forecasts, analyses, and reports for computer software in conformance with the work breakdown structure (WBS) to be developed. Status reports will indicate predicted and actual technical progress against the Software Development Plan. Cost/Performance reports will be required on a periodic basis. The AFVTF plans to initiate an Automated Program Management Control System (PMCS) which will maintain, analyze, and display management data.

5.3.3 Program Management Control System (PMCS)

5.4 QUALITY ASSURANCE

The system integrator and developers will establish and maintain an on-going quality control program for the software development process, and perform tests to demonstrate compliance of the computer programs with the specified requirements. Design methodology is explained below; testing methodology is explained in Chapter 6. The following quality assurance procedures will be adhered to in order to maintain quality control:

- o Participate in al formal reviews and walkthroughs to ensure their completeness and accuracy
- o Review and take part in the approval of all developer submitted software documentation
- o Maintain appropriate records of all assessments and tests in support of the following activities

    A. Management decision points
    B. Program validation
    C. Post deployment baseline change evaluation
    D. Post deployment test management
    E. Technical data base

- o Advise the Director, AFVTF on the performance, quality, and supportability of the software program

- o Perform continuous assessments of the developer Software Quality Assurance (SQA) Program to ensure that reviews, audits, verification, testing, and procedural and product aspects of system development are performed IAW the guidelines of Section 5.9 of DOD-STD-1679, MIL-S-5779 and contract requirements
- o Evaluate and approve the final IV&V Plan and monitor the actual acceptance test of the software program to ensure all requirements and documentation are verified
- o Assure that the SQA Plans are adequate and meet required guidelines

5.4.1 <u>Human Factors Engineering</u>

5.4.2 <u>Software Design Methodology</u>

Developers will use a design methodology that conforms to the Government specification and internal corporate requirements as approved by the government. This methodology will include a top-down design concept and sufficient management reviews to provide visibility to management of software development status. DOD-STD-2167 shall be used as a guide. Review the Development Philosphy in Chapter 2, Program management.

5.4.2.1 <u>Methodology</u> - Computer software development entails activities described below and will be in conformance with the contract requirements. Although described as sequential activities, the use of a top-down development approach may cause computer software development activities to proceed concurrently. Different portions of the computer software may be developed in parallel; however each will proceed through Requirements, Analysis, Preliminary Design, Detailed Design, Coding, Unit Testing, and CSC Integration and Testing, CSCI Testing, System Integration

and Testing, and Operational Testing and Evaluation of the Engineering Life Cycle.

5.4.2.2 Requirements Analysis - A complete set of functional and performance requirements will be established for each Specification. The requirements analysis will continue during the DPO Phase to completely define the requirements. Interface requirements will be defined between software and hardware specifications. All adaptations needed to accommodate different user sites shall be identified. Requirements analysis will evaluate requirements for completeness, consistency, adequacy, testability, understandability, and supportability. As mission needs change, continuous analyses will be required to determine to impact on software requirements.

5.4.2.3 Preliminary Design - A modular top-level software design will be developed from the software requirements. The design process will consider various design alternatives, analytical results, trade-off studies, and capability to accommodate change. The design will identify computer software components (CSCs) and shall define the data interfaces, control flow, and resource budgets for memory and execution time at the CSC level. Functional software requirements shall be assigned to CSCs of the top-level design. Initial data base designs will define the structure and organization of the data base.

5.4.2.4 Detailed Software Design - Detailed software design will refine the CSCs of the top-level software design to successively lower-level design elements until, at the lowest level. they specify individual units to be developed. The detailed design will define all information required for coding these units, including control logic, algorithms, data, accuracy, and timing. For any interfaces with other software and hardware

specifications detailed interface design will precisely define data formats, data flow, and timing constraints in sufficient detail for coding data structures and control routines. Data base designs shall be defined, including constituent items, fields, records, and files.

5.4.3 Hardware Design Methodology

5.4.3.1 Computer Hardware Design

5.4.3.2 Communication System Design

5.4.4 Quality Assurance Plan

A developer software quality system will be documented in a Quality Assurance (QA) Plan IAW DOD-STD-1679. The plan will present the contractor quality organization, standards, procedures, facilities, and reporting system. The ACRWG will incorporate contractor QA plans into the CRMF after contract award. Any special requirements which may be imposed on the contractor will be included.

5.4.4.1 Software Quality - The integration contractor(s) will implement quality assurance plans under the supervision of the AFVTF throughout the DPO Phase. The AFVTF will ensure that the contractor plans, defines, and executes adequate software quality procedures for all software development activities and products.

5.4.2.2 Independent Verification and Validation (IV&V) - AFVTF will implement IV&V procedures during development. Procurement activities for the IV&V effort will be completed as soon as practicable to allow for independent verification of the software products. The IV&V function will be performed by the system integrator. AFVTF will define the interface between the IV&V agency and the development agencies; provide the IV&V agency with copies of the appropriate development specifications, design documents, listings, and technical data; and monitor the satisfactory resolution of all discrepancies found by the IV&V agency. IV&V will be supported by an IV&V Plan which will be developed by a Government agency (to be determined).

5.5 DEVELOPMENT SCHEDULE

The development schedule for the AFV computer software programs is shown in Figure 5.2. An expanded development schedule is located at Appendix J.

5.6 STATUS REPORTING AND MONITORING

Development monitoring, formally and informally, and status reporting procedures provide the primary means by which the AFVTF will monitor software program development efforts. The Work Breakdown Structure (WBS) establishes the framework for reporting program cost, schedule and technical performance and is the basis for uniform planning, status reporting, program visibility, and assignment of responsibilities. The contractor (or developer) will be required to report in accordance with the individual CDRL's and/or established milestones.

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Computer Software
Development Schedule

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                      88        89        90        91        92        93        94        95        96
                 [..PoP..]I/II [..........DPO...........] III[.......FSD........]
architecture
B2C2                   prelim draft  final   prototype
VCOS                   prelim draft  final   prototype
VETRONICS              prelim draft  final   prototype

SYSTEM SOFTWARE
requirements           prelim draft  final
prelim design                    prelim draft  final
detail design                              prelim draft  final
coding                                               prelim draft  final
CSC integration                                                          *
CSCI testing                                                                       *

management
LCSEC                  plan    [...system integrator....]  [......AFVTF......]
ACRWG                  [....................AFVTF..................................]
CRMP          prelim draft                                 final
REVIEWS                                    PDR   SRR   SDR   SSR   TRR   FCA
                                                                         PCA
                                           CDR               CDR         FQR
```

Figure 5.2

5.6.1 Project Milestone Charts

Per contract requirements, the AFV developers will submit, project milestone charts which shall graphically depict the major program milestones and [contract] deliverables and report of the actual work status against the planned activities. These reports will aid the AFVTF in the timely analysis and resolution of each anomaly or deficiency, especially in the area of time-critical computer software program development.

5.6.2 Status Reports

All Developers and supporting organizations will be required to report technical progress on a regular basis. This report will describe technical progress, accomplishments, assessments of progress in terms of schedules, potential problems, contingency plans, plans for schedule recovery for items which are behind schedule, and plans for the following time frame. As backup for this deliverable, the developer will implement an internal software task management system which will indicate for each software program/task the personnel assigned, the planned schedule, and the current status. This data will be available for review by the government or its representative as deemed necessary by the AFVTF or required in accordance with the AFV FSD Contract CDRL(s).

5.7 DEVELOPMENT/TEST RESOURCE REQUIREMENTS

The resources required for the development and test of the AFV computer software programs will be provided by the contractor as apart of the Software Development Station (SDS) operational requirements. The SDS requirements and necessary resources are described in the paragraphs which follow.

5.7.1 Growth Capacity and Supportability

These are areas where proven concepts and existing computer resources will be used during development, test, integration, production, and deployment of the AFV. As discussed earlier, military standard hardware and software may be utilized if practical. In addition, AFV planning emphasizes use of the following resources.

- o Automated Configuration Management Support
- o Automated Documentation Support
- o Computer Software Programs
- o Common, Standard, and Reusable Software Modules or Components
- o Proven and thoroughly tested Algorithms
- o Test Facilities
- o Software Development Station(s)
- o Simulators/Emulators
- o Prototypes

5.7.2 Software Analysis

Software selection should be based on expected performance goals. Algorithm analysis should be based on correctness, amount of work done, amount of work accomplished, space used, simplicity, optimality, testability, and maintainability. This directly implies that software modules should be small and will be documented. Algorithm complexity in best, worse and average cases should be less than polynomial.

5.7.3 Hardware Facilities

Specific hardware configurations will be presented in the CRMP when defined. Typically, target vehicle hardware will not be available until the Development/Proveout (DPO) Phase.

Therefore, software development on mainframe computers should simulate/emulate (to include input/output performance) the Fighting Vehicle (FV) environment. Hardware configuration information will be incorporated into the CRMP during a scheduled update cycle.

5.7.4 Support Software

The development support software ll include tools for editing, compiling, assembling, linking, debugging, testing, simulating, and documentation to facilitate rapid correction, test, verification, and maintenance of program modules. Automatic software documentation support is an absolute necessity. All software simulators, test programs, and data bases created to exercise and assist in the verification of the AFV functional design will be documented.

5.7.5 Management and Control Software

Capabilities of the Software Development Station (SDS) to support the management process will be presented here. This will include such items as: access control, status reporting, module interface verification, library control, and job activity.

5.8 DEFICIENCY MANAGEMENT

Deficiencies, errors or faults are often thought of as adverse results of running hardware components or testing a program. Deficiency or error management occurs throughout the engineering life cycle. There are user requirements, technical specifications, and program errors. Chapter 6, Test and Evaluation, and Chapter 7, Plan for Support also contains deficiency management guidance.

5.8.1 Software Deficiency Management

Software deficiency management is the reporting, monitoring, and resolution of computer program errors and deficiencies during development and testing. It includes the establishment of reporting criteria, report preparation and routing instructions, and the action agency's report handling procedures.

5.8.2 Specification Deficiency Management

This class of error or deficiency management is related to errors found in user requirements and faults in program specifications. Testing is not the only way of detecting these deficiencies. Specification developers will employ a system to detect and correct such problem areas.

5.8.3 Hardware Deficiency Management

5.9 SIZING, TIMING AND PERFORMANCE MANAGEMENT

The developer will prepare and maintain timing, sizing, and performance data and estimates which will be reported in accordance with appropriate CDRL items. Methods for recording, reporting, analyzing, and monitoring the sizing, timing, and performance of critical programs will be identified. Automated performance evaluation suites will be used for consistency in the evaluation of software performance.

5.10 CONFIGURATION MANAGEMENT

Configuration Management (CM) forms the cornerstone of the AFV acquisition strategy as described in this document, and centers on control of the hardware and software baseline. During the development period, the responsibility for executing the configuration management function will rest with the Automation and Communications Resources Working Group (ACRWG) and eventually with the AFV PEO integration contractor(s). During the post deployment phase, the designated LCSEC(s) will accomplish configuration management under the supervision of the AFVTF (or AFV PEO). The Director, AFVTF will require that the procedures to implement CM conform to DOD-STD-2167 and be incorporated in the Software Development Plan. The following considerations will apply to CM control to assure that the objectives of the CM program are obtained.

5.10.1 Configuration Identification

Developers will ensure that the baseline documents comply with contract requirements and/or specifications. Once approved, the documents will serve as baselines for control changes. All computer and communications hardware subsystems are configuration items. Software (System, Cycle, Program, and Modules) are also configuration items

5.10.2 Configuration Control

The developer representatives will be a permanent member of any government software configuration review/control board when it is established. They will review all proposed changes and will provide the board with an assessment of adherence to the quality assurance standards for the proposed change and/or proposed configuration. The developer will evaluate the proposed action for completeness and quality assurance provisions. See section 5.13, Configuration Management Plan.

5.10.3 Status Accounting

Developers representatives will periodically review the configuration management status accounting documents (configuration index, change status reports, etc.) to ensure that all proposed or approved changes are tracked to provide traceability throughout the software development cycle of the AFV program life cycle.

5.10.4 Audits

Periodic audits will be performed on Configuration Management (CM) practices to assure compliance with the CM Plan, applicable contractor standards and procedures, and contract requirements. The AFVTF (LCSEC) representative will also attend the Functional Configuration Audit (FCA), Physical Configuration Audit (PCA), and Functional Qualification Reviews (FQR) to verify and certify product integrity prior to acceptance.

5.11 GROWTH, MODULARITY AND MODIFICATION

During periodic reviews features for planned and actual growth capability, modularity, and ease of modification will be examined.

5.12 DOCUMENTATION PLAN

5.12.1 General Approach

Documentation is an integral part of software through all phases of development, including system integration and test. AFV program documentation shall provide a continuous representation of the evolving state of the software, providing traceability. The documentation aids the developer in maintenance and operation of the software. Since the documentation is an integral part of the development process, it provides visibility to management of the status of software throughout its life cycle. Developers must have automated support in this area.

5.12.2 Traceability

Traceability by documentation shall be implemented as follows:

5.12.2.1 Cross-Reference Traceability

Cross-reference traceability requires that there is a section of each software document that references related documents. This provides the ability to locate associated hardware, software, and interfaces. The documentation also reference appropriate system specifications. Reference to software documentation are through the assigned AFV software configuration control number.

5.12.2.2 Correspondence Traceability

Correspondence traceability requires that the documents be organized in such a manner that the topics listed in the table of contents of a predecessor document, except for major paragraph headers already established in Data Item Descriptions (DID's), are duplicated in subsequent documents with additional levels of detail provided. Correspondence traceability provides a means of correlating test specification and test procedures.

5.12.3 Naming Conventions

Naming conventions applied in high level documents to programs, functions, data elements, etc. shall remain unchanged in subsequent documentation, except for the number of characters allowed when such information is found in the program listing. This consistent naming policy provides traceability between the documents generated at various stages of the software development.

5.12.4 Software Documentation

The following documents shall be prepared as part of the AFV software development program:

- Software Development Plan (SDP)
- Software Design Specification (SDS)
- Software Requirements Specification (SRC)
- Software Product Specification (SPS)
- Software Top Level Design Document (STLDD)
- Software Test Reports (STR)
- Software Test Plan (STP)
- Software Test Procedures (STPR)
- Version Description Documents (VDD)
- Computer Resources Integration Support Document (CRISD)

5.13 CONFIGURATION MANAGEMENT PLAN

This plan addressed the implementation of the configuration management discipline for software documents. Software control shall conform with applicable military standards including. MIL-STD-483A, MIL-STD-490A, and MIL-STD-1679.

5.13.1 Computer Program Configuration Item

The fundamental unit for control is the Computer Program Configuration Item (CPCI) as defined by MIL-STD-483A.

5.13.2 Software Configuration Management

Specific responsibilities of the Software Configuration Management Function are:

- Prepare and maintain a configuration management plan which will be the basis for configuration management performance during the program.
- Prepare and publish specific methods as necessary in order to accomplish the program objectives.
- Provide direction concerning requirements for configuration identification.
- Provide direction and guidance for the preparation of CPCI specifications.
- Allocate, through utilization of a specification tree method, the criteria of the requirements and determine that the intent of the requirement specification is achieved.
- Assist development engineering in providing specification change notice (SCN) and specification development records.

- o Provide direct and positive control of engineering changes affecting software. This requires the establishment and administration of a formal change control board and submittal for approval when applicable.
- o Conduct formal configuration audits.
- o Identify and maintain baseline configuration identification and status accounting data. This includes both contractual data (such as engineering changes and specification changes and specification change notice status) and software.
- o Review and approve test report.

5.14 SOFTWARE DEVELOPMENT APPROACH

The software development methodology for the AFV shall be a top-down structured approach for producing and testing software. Predominant characteristics of the software development shall be: use of HOL (Ada); top-down design; program modularity; periodic reviews; and, phased, top-down integration and testing. Ada PDL shall be utilized for the design of the system development software. The Ada PDL shall conform in its syntax and semantics with the Ada language as specified in ANSI/MIL-STD-1815A. This human readable and machine processable PDL shall be used to communicate design decisions among software development personnel and to facilitate early identification of design errors. The software development process can be divided into the following phases: planning, requirements definition (system specification), analysis, preliminary design, detailed design, coding (implementation), unit testing, CSC integration and testing, CSCI testing, system integration and testing, and operational testing evaluation of the engineering life cycle. Planning phases are discussed below.

5.15 SOFTWARE REQUIREMENTS DEFINITION PLAN

A successful software development program begins with a detailed, well thought-out requirements definition. The allocation of fundamental requirement to Computer Program Configuration Items (CPCI) shall be based upon a thorough analysis of total system requirements and may require simulation studies and processor/host system research. A systematic study of data transfer requirements for the proposed architecture shall be made to determine data transfer rates that are at such a rate that will meet requirements for each subsystem element. Test requirements shall also be generated. This phase culminates in the formulation of a development specification for each CPCI.

5.16 SOFTWARE DESIGN PLAN

The software design phase allocates CPCI requirements as specified in the development specifications to fundamental components and then to the compilation unit level. The objective is to formulate a design that meets performance objectives, is modularized to allow shared responsibility in the implementation phase and adaptability to design changes, and is producible and testable utilizing an incremental implementation, test, and integration philosophy.

5.16.1 Ada-Based Program Design Language

The AFV software shall be designed using Ada-based Program Design Language. The PDL shall be used to generate both B-5 and C-5 specifications.

5.17 SOFTWARE IMPLEMENTATION PLAN

The objectives of this AFV software development phase are to design and code compilation units (CU) and have each CU successfully pass subprogram testing. Preparations of subprogram tests shall be made in parallel with CU coding. Walk throughs shall be held to verify that each CU conforms to programming standards, satisfies the requirements and implements the design in the B-5 specification. Test procedures shall be reviewed to determine proper reflection of B-5 test requirements and to verify an adequate functional text.

5.18 SOFTWARE INTEGRATION

AFV software shall be done in a top-down manner in an environment that as closely as possible resembles real world operational conditions. Integration tests are needed to verify operations of the AFV CPU and it's software modules, and to ensure that the software units interface properly and conform to the corresponding design. This testing demonstrates that the control and data flow between units is properly maintained, that all units and stubs are present and that the unit is sufficiently stable to permit functional requirements testing.

5.19 SOFTWARE TESTING AND EVALUATION PLAN

The purpose of AFV software testing shall be to evaluate the performance of this software in meeting the system requirements. Testing shall be planned and executed for the purpose of providing a formal basis for program performance evaluation. The test documents shall reflect a top-down approach to testing that is carried throughout testing, integration, and retest.

5.19.1 Test requirements are generated simultaneously with design requirements. Test requirements are refined continuously throughout the design cycle from initial system level design down to compilation unit design. Types of testing used shall include: subprogram (CU level) tests, integration tests, and functional requirements tests.

5.19.2 Subprogram test are also known as unit design qualification. these tests shall demonstrate that:

- o The CU compiles with our errors.
- o The correct flow of control occurs through a CU with executable code.
- o The proper numerical results are obtained from a CU containing calculations.
- o The calculations within a CU meet the relevant requirements for stability, convergence, scaling, and range.

5.19.3 When a group of CUs have passed subprogram tests, integration tests begin. Integration testing verifies correct data interchange between CUs within a CPCI and also among CPCIs within the entire system.

5.19.4 After the interfaces have been properly verified, testing of functional requirements begins. Requirements specified in the development specifications are then tested. The tests shall be designed to provide a complete checkout of the proposed architecture.

5.19.5 Operational software shall be verified over the complete AFV operational envelope. In-operation fault detection software shall be verified by introducing faults into various subcomponents, sensors, and/or actuators, one at a time. Performance following the introduction of these faults will be monitored to demonstrate that requirements are being meet.

5.19.6 At the conclusion of software development testing, the finalized software program will be committed to production and full documentation.

5.20 PHYSICAL RESOURCES

A wide variety of physical resources are required for successful software development. The primary resources are: design and host facilities, target processors, and test facilities.

5.20.1 Design and Host Facilities

Design facilities include word processors, Program Design Languages (PDL), and their associated hosts, personal computers, etc. Host computer facilities include software development tools such as compilers, assemblers, linkers, printers, plotters, etc. Host facilities may be large main-frame computers, or more preferably, the smaller microcomputer that can programmed using self-contained Micro Development Programs. The following guidelines should be followed in the selection of the host facilities for the AFV software development effort:

- o Availability of a reliable Ada compiler.
- o Maturity of the compiler. Debug of compiler problems and the work-around required can be costly.
- o Availability, maintainability, and cost of peripherals.
- o Target processor selection. Host compiler must produce object code of target processor.

5.20.2 Target Processor

In selection of a target processor, a careful balance must be maintained between cost, size, and weight factors, and the memory and throughput requirements imposed upon the processor by the AFV system. Software costs escalate exponentially as memory utilization nears capacity. Good software design can protect critical functions from degrading when throughput demands exceed machine capability.

5.20.3 AFV Processor Selection Guidelines

- o Ada compiler targeted to the processor.
- o Capability for handling throughput.
- o Sufficient memory capacity.
- o Cost, size, and weight factors.
- o System architecture/bus compatibility.
- o Software loading methodology.
- o Test support facilities.

5.21 ENGINEERING PRACTICES

The design approach will stress hierarchical structure, independence of components (loose coupling), modularity, and clarity of interconnections. Documentation will stress traceability of software specifications to actual testing, formal standards, clarity of descriptions, and easily readable listings. Testing will stress formal demonstrations of mission requirements and use formal error data collection methods. The following software engineering practices and standards will be used in the development and maintenance of the AFV software.

5.21.1 Quality Assurance Practices

To ensure quality, the developers shall employ approved Quality Assurance contractor practices or substitute Government approved equivalent practices which could include the following:

- o Structured Design
- o Top Down Development
- o Chief Programmer Team
- o Formal Standards and Guidelines
- o Data Item Index
- o Hiercharchy plus Input/Process/Output
- o Structured Programming
- o Unit Development Folders w/automated assistance
- o Structured Walkthroughs
- o Programming Support Library
- o Formal Error Data Collection

5.21.2 Standards and Conventions

The standards and conventions affecting the AFV development effort are specified in appropriate sections of the Statement of Work and the Contract Data Requirements List. They provide specific detailed guidance for procedures, design, program structures and conventions, display and logic standards, and I/O signal standards. They include:

- o Specification standards
- o Documentation standards
- o Programming standards
- o Quality Assurance standards
- o Configuration Management standards
- o Testing standards

5.21.3 Development Procedures

The software engineering practices that are employed in the development of the AFV software are described in DOD-STD-2167. Monitoring and enforcement of the practices will be accomplished by the management procedures presented in Chapter 2 of the CRMP. The engineering practices that will be used are:

- Software Tool Development Environment
- Structured design
- Top down design
- Functional diagram
- Software development files
- Structured walk through
- Formal test methodology
- Software update procedure
- Data item index and cross reference
- Supportable data structures
- Communication Integration

5.21.4 Common, Standard, and Reusable Software Components

Maximum use of common, standard, and reusable software components is mandatory. The AFVTF will be responsible for the establishment and function of a standard software review committee under the automation communication resource working group (ACRWG) for the purpose of evaluating software component designs. The ACRWG may recommend a standard software component to replace a proposed design or it may accept the proposed design as a standard. The ACRWG will be responsible for the publication of a catalog of common, standard, and reusable software components pertinent to the AFV program.

5.22 SECURITY REQUIREMENTS AND CONTROLS

The AFV security classification guide, (to be developed), will include AFV software security requirements. Material covered in the guide may effect:

- Computer Software Programs
- Data Base
- Data Storage

- Access Control
- TEMPEST Requirements
- Declassification Techniques and Control
- Data Links
- Document Control
- COMSEC and OPSEC Requirements

5.23 INTEROPERABILITY AND INTERCHANGEABILITY

5.23.1 Army Command and Control System (ACCS) Interoperability

The requirements for the AFV automation and communications resources are based heavily on 52C2 systems and on the Fighting Vehicle's internal control requirements. The requirements are also based on the need to communicate with ACCS components. Interoperability of protocols, data components, and formats between the AFV and ACCS components (all mission areas) is required.

5.23.2 U.S. Navy and Air Force Interoperability

5.23.3 NATO Interoperability

Rationalization, Standardization, and Interoperability issues for the AFV with regard to NATO are covered separately in Chapter 5 of Volume III, Requirements Review or ASARC Documentation. It is intended that the AFV automation and communications resources be interoperable to the maximum degree possible commensurate with AFV acquisition schedules and with National interests. Applicable NATO standards shall be met when possible.

5.23.4 Vehicle Interchangeability

AFV vehicle subsystem interchangeability is base on two levels of commonality; family and chassis. Family commonality refers to AFV wide or universal commonality. Chassis commonality refers to the components or subsystems common to a particular AFV weight class. Family common command, control, communications (C4) and electrical subsystems shall be 100% interchangeable due to the modular design of the AFV. Chassis common subsystems will also be 100% interchangeable. Interchangeability goals for an AFV mission module unique components will be determined

5.24 SIMULATION TECHNIQUES AND REQUIREMENTS

To the greatest extent possible, operational C4 and electrical system mock-ups will be developed. The minimum objective is to determine or confirm the human factors engineering analysis for physical configuration. The Maximum objective is to validate the interface and interconnection of C4 and electrical system components or subsystems. Simulation will be used to determine the force level effect of AFV C4 components.

5.25 SUMMARY, DEVELOPMENT MANAGEMENT

Chapter 5 discusses the management approach and the methodology for the development of automation and communications resources for the AFV. While Chapter 5 follows DOD standards for documentation it also imposes management organizations not normally used for the development of computer resources.

CHAPTER 6 - TEST AND EVALUATION

6.1 INTRODUCTION

This Chapter of the CRMP addresses the management of the test and evaluation of the Armored Family of Vehicles (AFV) computer resources. It presents the plan and schedule for development of test plans for testing, verification, and validation of the automation and communications resources for the AFV.

6.1.1 Testing Goal

The goal and explicit purpose of computer resource testing is to determine failure. Failure is defined as the determination that an error exists in system requirements, specifications, design, programs, equipment or testing methodology. The vast nature and complexity of AFV computer resource applications demonstrates that 100% testing is impossible. The myriad of possible combat scenarios, soldier operations, and sensory inputs prevents total testing. Therefore each piece of the vehicular electronics must be tested separately and in various combinations. System integration testing methodologies that can assure selected levels of testing will require further refinement.

6.1.2 Testing Policy

Deployment of a system implies that sufficient testing has been accomplished to assure that the system satisfies its

specifications/requirements and is performing as designed. All changes must also undergo sufficient analysis and testing to ensure that system quality and functions are preserved. Designated test agencies will coordinate with TRADOC, AMC, and other proponent agencies to determine the degree and method of testing required for each AFV system modification.

6.1.3 Test and Evaluation Master Plan

The Test and Evaluation Master Plan (TEMP), published separately, addresses the approach and methodology of testing, the objectives of the testing, the resources required, the responsibilities and interaction of the involved agencies and commands, and the purpose and function of the Test Integration Working Group (TIWG). A Test and Evaluation Master Plan (TEMP) shall be prepared separately by the chair of the TIWG in accordance with AR 70-10, and in conjunction with the other members of the TIWG (See Figure 6-1). The TEMP will identify the test plans, testing, and schedule for the technical Development Testing (DT) and user Operational Testing (OT) of the AFV. It will identify the test concepts and the critical issues which must be addressed for the AFV. As a minimum, the TEMP will incorporate the following:

- Test will not be repeated if satisfactory results can be obtained through other test efforts.
- A program will not move to the next phase or project objective until all significant deficiencies are identified and corrective measures are planned.
- Developmental Testing & Evaluation (DT&E) will verify attainment of technical specifications and objectives.
- User Operational Testing & Evaluation (OT&E) will assess the system's operational effectiveness and suitability.

- o Testing and nondevelopment items will be production tested to insure compliance with contractual requirements.
- o Organizations having logistics and user responsibilities will participate in the test program.
- o Test cycles will be coordinated to minimize resource needs, prevent duplication, and maximize data yield.

6.1.4 TEMP and CRMP Evaluation

The goal of the TEMP is to provide managerial guidance concerning the entire AFV. This section of the CRMP focuses on automation and communication resource testing. Consistancy between the Test and Evaluation (TEMP) and [Communication] Computer Resource Management Plans must be maintained. Organizations identified in Chapter 3 are responsible for TEMP and CRMP review to ensure consistency is maintained. Inconsistencies and recommendations must be immediately reported to the CRMP AFV point of contact identified in Chapter 1.

6.2 TEST ORGANIZATION AND RESPONSIBILITIES

6.2.1 Organization

The organizations and agencies that are responsible for the test and evaluation of AFV software and hardware are defined in paragraph 6.2.2. These activities perform varied roles during the development and operational test phases and must cooperate as team players to assure the success of the Test and Evaluation Master Plan. Following further full scale development, this section will be expanded to include the identification of those organizations responsible for independent verification and validation of software. The current procurement

philosophy precludes their being identified at this phase of AFV development.

6.2.2 Responsibilities

The Director, AFVTF has overall responsibility for assuring that the Test and Evaluation Master Plan is successfully executed. Primary test coordination will be accomplished through the TIWG and ACRWG. Specific responsibilities of the organizations depicted in Figure 6-1 will be incorporated upon publication and approval of the preliminary AFV TEMP.

6.2.2.1 AFV Task Force. The Director, AFVTF manages the TEMP as set forth in the TEMP and supplemented in this Chapter of the CRMP.

6.2.2.2 Test Integration Working Group (TIWG). Chaired by the AFVTF Deputy Director for Combat Development, the TIWG provides a forum for direct communication to facilitate the integration of test requirements and to speed the TEMP process. The TIWG will define the responsibilities and interrelationships of the materiel developer, combat developer, logistician, trainer, developmental and operational testers and evaluators, LCSEC, and other concerned organizations during the various levels of software testing. The organization, purpose, and activities of the TIWG are contained in the AFV TIWG Charter which will be incorporated as an Annex to the TEMP when approved and published.

6.2.2.3 Automation and Communcation Resource Working Group (ACRWG)

Review Appendix C, Charter for the ACRWG and Chapter 3, Program Management.

6.2.2.4 Army Materiel Command (AMC)

6.2.2.5 Training and Doctrine Command (TRADOC)

6.2.2.6 Operational Test and Evaluation Agency (OTEA)

6.2.2.7 Tank and Automotive Command (TACOM)

6.2.2.8 Army Materiel Systems Analysis Activity

6.2.2.9 Communication and Electronics Command (CECOM)

6.2.2.10 Program Executive Officer

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Test and Evaluation Master Plan Organization

System Details

1. Mission Description
2. System Description
3. Required Technical Characteristics

Program Summary

1. Management
2. Integrated Schedule

Developmental Testing & Evaluation Outline

1. Critical Technical Characteristics
2. DT&E to Date
3. Special Requirements for System/Subsystem Retest
4. Future DT&E

Operational Test & Evaluation Outline

1. Critical Operational Issues
2. OT&E to Date
3. Future OT&E

Test and Evaluation Resource Summary

1. Test Articles
2. Test Sites and Instrumentation
3. Test Support Equipment
4. Threat Systems
5. Test Targets
6. Operational Force Test Support
7. Simulators, Models, and Testbeds
8. Special Requirements
9. T&E Funding Requirements
10. Resource Schedule
11. Manpower/Training

Figure 6-1

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TEST ORGANIZATIONS AND RESPONSIBILITIES

ORGANIZATION	RESPONSIBILITIES
AFVTF	
TIWG	
ACRWG	
AMC	
TRADOC	
OTEA	
TACOM	
AMSSA	
CECOM	
PEO	
Contractors	
System Integrator	

Figure 6-2

6.2.2.10 Contractors. Contractors will be responsible for actual performance of the major portion of Developmental Test and Evaluation (DT&E) to demonstrate compliance of the computer software programs with the computer software development specification of the AFV with the system specification. Contractors will also be responsible for providing all computer resources and related support facilities necessary for accomplishing the DT&E of the AFV software. Contractors may be required to provide selected computer resources and related support facilities for Operational Test and Evaluation (OT&E).

6.2.2.11 System Integrator. The system integrator will be responsible for software validation, verification and testing of computer software components in the AFV during DT&E and will provide computer software testing support during OT&E. The testing of computer software components at the integrated level will include software component interfaces to internal AFV functions such as weapons systems and external interfaces to battle management functions such as communications. The integration contractor will construct and maintain a AFV computer resources prototype for use by contractors during DT&E. Control and management responsibility of the computer resources prototype will pass to the AFV LCSEC(s) at the completion of OT&E.

6.3 SPECIFICATION TESTING

Specifications will be tested. The goal of specification testing is to determine specification errors prior to programming or hardware development. Algorithms specified in the specification documents will be thoroughly analyzed. The ultimate goal of this analysis is to achieve a best possible rigorous proof of specification algorithms.

6.4 COMPUTER HARDWARE TESTING

Hardware testing requirements have not been fully developed at this time. However, for planning purposes hardware testing schedules should coincide with software testing.

6.5 SOFTWARE TESTING METHODOLOGY

Plans will be developed for testing compliance of the specification for each software requirement and applicable interface requirement. The testing approach will be in conformance with the Test and Evaluation Master Plan (TEMP). Software test planning will include both formal and informal tests.

6.5.1 Formal Testing

Formal tests will be developed for each software requirement and for all critical software components and interfaces which represent an area of risk within the system. Formal tests will include stress scenarios, such as capacity tests and error handling conditions. Formal tests will require Government-approved test descriptions and procedures, will be witnessed by the Government or a Government-designated representative, and will be documented by a test report for Government approval.

6.5.2 Informal Testing

Informal tests are internal contractor development tests conducted during coding and unit testing and specification integration and testing. Informal tests will address and demonstrate the correct functioning of all software components under realistic loads, the proper and complete allocation of all software functions, and the correct implementation of specification interfaces. Although test descriptions, procedures, and reports for informal tests do not require government approval, they will be documented by the contractor and made available for Government review.

6.5.2 Testing Requirements

The objective of the software testing effort is to ensure that each new version of a computer program distributed to the deployed system is correct and fulfills the associated operational requirements. The Software Testing activities of the AFV LCSEC will be conducted as described below. Deviations from these policies will be made only with the written approval of the Chief, LCSEC.

6.5.3 Test Requirements Analysis

Computer program functional requirements, including acceptance criteria, will be specified in the Computer Program Development specifications and the requirements for qualification test will also be specified. Contractor analysis of these functional requirements, acceptance criteria, and qualification test requirements will be the basis for generating the Qualification Test Plan and associated test schedules. This analysis will also enable the contractor to determine the test tools and simulation models, and their acquisition/development schedules, needed to support both qualification test and engineering development tests.

6.5.4 Test Plans - The System Test Plan will include definition of the requirements for tests to demonstrate that the developed software meets all Software Development Specification requirements. The test plan will describe locations, schedules, and limitations of the tests; preparation of input data; methods for analyzing results; and requirements for equipment, support, software, and personnel.

6.5.5 Test Planning

The AFV LCSEC (or AFVTF designee) will determine the scope of testing required to ensure that the software modifications made meet all specified technical, operational, and performance requirements and the acceptance criteria. Test planning will include development of:

- o Software acceptance criteria at each level of testing
- o Specific objectives at each level of testing
- o Internal procedures for scheduling and conducting tests
- o Detailed procedures for conducting testing
- o Procedures for reporting test results.
- o Specification and Design testing.

All test plans, specifications, and procedures will be subject to the review and approval of the AFV designated LCSECs.

6.5.6 Levels of Software Testing Required

The AFV LCSEC will test all software and software changes which it produces and ensure that each aspect of the software is thoroughly exercised.

6.5.7 Programming and Unit Testing

Programming and unit testing includes testing accomplished during actual programming of a software program or unit and it includes testing of the unit according to design and to performance within a system.

6.5.7.1 Programming - During this activity, the detailed design will be translated into program code and data definitions, and the resulting units of code will be tested. The AFVTF will carefully monitor contractor progress using quantitative and qualitative measures of progress, especially when coding spans an extended period of time or when a large amount of code is being developed.

6.5.7.2 Programmer Unit Testing

Unit Level testing is the responsibility of the programmer. Prior to unit level testing, a code walk-through will be conducted by the project engineer responsible for that software product. As a minimum, unit level

testing will be performed to ensure warning or error free compilation and assembly of the coded unit, to ensure that the coded unit fully satisfies the detailed performance and design requirements, to ensure that input and output expectations are met, and to ensure that all code delivered has been fully exercised.

6.5.7.3 Unit Level Testing - Unit testing is part of the informal whitebox testing program. Before beginning unit testing, test procedures for unit testing shall be defined. Government approval of these test procedures is not required. Unit testing shall exercise individual software units to check for agreement with detailed design, correct execution, and proper data handling. The objectives of unit testing are to assist in the development of the specifications for each software requirement, to provide visibility into the progress of the development, and to prepare for formal testing.

6.5.7.4 Black Box Testing. - Unit level testing will consist of formal black box tests to verify that each function of the unit, or aggregate of units satisfies the Software Requirements and applicable Interface Requirements. Formal testing will be performed in accordance with the STP, STD, and Software Test Procedures (STPR). Formal testing is a primary criteria for determining system acceptance; therefore, prior informal testing results will not be used in place of formal testing. For those modules (such as a utility program) which are relatively insensitive to system operation, formal testing may be conducted at the developer s facility. For large operational modules, the complexity of the performance requirements may require additional testing usir the integration contractor computer software prototype or during later DT&E or OT&E. The AFV PMO will assiduously monitor contractor progress to assure performance meets all aspect of the STD, STP, and the STPR.

6.6 SOFTWARE STRESS TESTING

The Software Stress Test will exercise all functions of the software for a period of time in order to demonstrate that the software is free of serious or numerous errors. Under this test, the software is to be tested to the limits of its designed capacities and beyond, in order to ensure that degradation at the point of saturation is not catastrophic. Methods of stressing the software shall include, but are not limited to:

- o Provide more information to be processed than the processor is designed to accommodate.
- o Saturate the data transfer capabilities by requiring more data to be transferred in and out of memory, peripherals, subsystems, and interfacing systems than the system was designed to accommodate.
- o Provide zero input for processing to assist in null condition processing.
- o Exceed assigned storage are capacities, e.g., buffers, tables, and scratch areas.

6.6.1 Length of Stress Testing

The length of time of this test will vary depending on the complexity of the program and mission of the system under test. Initial system setup time to establish normal operating conditions will not be included as part of the test period.

6.6.2 <u>Stress Testing of Continuously Operated Systems</u>

For systems that are designed to operate continuously for more than one day at a time when the system is placed into operation, the minimum length of time of this test shall be 25 continuous hours.

6.6.3 <u>Stress Testing of Periodically Operated Systems</u>

For systems that are not designed to operate continuously or for more than one day at a time, the minimum length of time for this test shall be the length of time required to fulfill the system's mission(s), including any periods before and after the mission period or the length of time it takes to complete the test requirements, whichever is longer. The testing period shall be continuous.

6.7 <u>PREPARATION OF TEST DESCRIPTIONS</u>

Test Descriptions will define the methods and criteria of conducting the individual tests identified in the Software Test Plan (STP) when published. The STP will also identify any software that will not be tested. Each test case will be defined in terms of assumptions, inputs, expected results, and evaluation criteria. The test descriptions form the basis for subsequent development of test procedures. Descriptions of procedures for formal tests shall require Government approval. Individual tests will be fully defined in terms of the procedural steps to prepare for, execute, analyze the results of, and document that test. The AFVTF will carefully monitor contractor performance to ensure that the test procedure addresses all aspects of the previously defined STP and STD.

6.8 <u>COMMUNICATION SYSTEM TESTING</u> to be determined

6.9 AFV C4 ARCHITECTURE TESTING

The C4 and electrical system testing will be covered in the Integration Testing paragraph of this Chapter.

6.10 INTEGRATION TESTING

Integration Testing shall not begin until all of the units for the computer program have passed unit testing. Integration Testing will include at least the following events:

- o Ensure error free linkage; of the units
- o Ensure that the computer program meets the detailed performance and design requirements
- o Exercise the computer programs input and output
- o Ensure that the program can properly handle and survive erroneous inputs.
- o Levels of degraded performance to ensure system operational performance can be maintained while selected modules are non-operational.
- o Data and voice communciation can be achieved.
- o Interface and interconnection of components or subsystems with the AFV common bus architecture.

6.10.1 Software Integration and Testing.

This phase will successively integrate and test units of code and components until a complete software system is built. Integration and testing normally begin by integrating and testing the highest level software units, and then proceeding to successively more comprehensive levels of integration. Informal tests will be conducted to verify proper functioning of the components software modules prior to software module level testing. Formal tests will be conducted for those component function which are critical to the software module as determined by the time or performance requirements.

6.10.2 System Integration and Testing.

Software and hardware modules will be successively integrated and tested to validate that the complete system is properly integrated and satisfies system requirements. System testing shall focus on the interaction of hardware and software modules of the system, under nominal, stress, and endurance conditions. Methods of testing these interactions will comprehensively ensure that the software fulfills system requirements. System testing will be conducted, using the operational configuration or nearest possible equivalent, in accordance with the system-level portion of the TEMP. System testing may be accomplished on the computer software prototype provided by the system integrator. Participation by the LCSEC(s), the independent evaluators, and the user in system testing is strongly recommended.

6.10.3 Operational Environment Testing

The system will be integrated with other systems and tested. This testing will formally qualify the system to ensure that it functions properly in the operation environment. Tests will emphasize the interoperability of the system with the software and hardware modules of interfacing systems that exist in the operation environment.

6.11 DEVELOPMENTAL TESTING (DT).

Technical DT will be performed prior to Milestone III or equivalent to ensure that engineering is complete, that all significant design problems have been identified and solutions to these problems are in hand, and that the system is ready for user OT. DT encompasses all computer software and specification testing, hardware/ software system level testing, and system integration testing performed prior to User Operational Testing (OT). Director, AFVTF will ensure that software expertise is available during Government DT to support a valid technical assessment of the system.

6.12 OPERATIONAL TESTING (OT)

AFV user Operational Testing (OT) will be conducted, in an operational environment as determined by the test community. OT will ensure that the system will satisfactorily perform the mission for which it was designed. Sufficient OT will be completed before Milestone III or equivalent to ensure that the system is ready for production. OT will be managed by an independent OT agency, with support from the material and combat developer. AFVTF will ensure that the software expertise is available as required during OT to support the evaluation of the AFV system.

6.13 ACCEPTANCE TESTING - Acceptance testing will be the gateway event, which verifies that the software product does meet performance, design, and quality control specifications. Acceptance Testing will include the following:

- Ensure the total man-machine interface for the hardware/software package is acceptable.
- Ensure proper system initiation, data entries via peripheral devices, program loading, restarting, monitoring and control of system operation from display consoles, and from other control stations as applicable.

- o Ensure proper interfacing of all equipment specified in the program performance requirements.
- o Ensure the capability of the program to satisfy all applicable system and program performance requirements.
- o Ensure the capability of the system to handle properly and survive erroneous inputs.
- o Perform software quality stress testing.
- o Perform review of documentation.
- o Approval for Production. Prior to a full production commitment, AFV PMO will ensure that the operational requirements for both performance and supportability have been met. Approval of computer resources for production will require that: 1) the Functional and Allocated Baselines are current, 2) system-level FCA and PCA are completed, 3) the Product Baseline is established, and 4) all three baselines are under proper configuration management.

A description of the contractor's test methodology, as approved by the Government, will be inserted after contract award.

6.14 SUPPORTABILITY DEMONSTRATION

The plan for the conduct of the supportability demonstration for Life Cycle Software Engineering Support (LCSES) will be defined at the proper time and will be included in this CRMP. The plan will delineate and specify the requirements for the testing procedures, internal and external interfaces, equipment, and personnel as well as the methodology to be used to verify compliance with the requirements. The demonstration will exercise the support capability, in real time, to permit assessment and certification of its adequacy for the post deployment phase.

6.15 BENCHMARK TEST CASES

The results of automated computer software performance evaluations accomplished during development by the integration contractor will be documented and maintained by the AFV LCSEC during post deployment support of the AFV.

6.16 SOFTWARE DEFICIENCY PROCEDURES

The contractor will be required to prepare a software deficiency report on any software requirement, design, or test deficiency. Reporting of deficiencies will be done in accordance with the Statement of Work and CDRL. The contractor will be responsible for resolving all software deficiencies both during contractor DT, government DT, and government OT. All deficiencies will be identified and resolve prior to Milestone III.

6.17 TEST SUPPORT REQUIREMENTS

6.17.1 Special Tools

Three special testing tools have been tenatively identified and will be used in the testing of the AFV software and hardware. Development and acquisition of special test tools for the AFV has not yet been fully determined.

6.17.1.1 Automation and Communications Resources Prototype - The AFV system integrator will construct an Automation and Communications Resources Prototype (or mock-up) containing all computer related hardware and software components and interfaces or emulators of those components for use by contractors in the testing of software modules/components. The prototype will be used for developmental testing at the systems level and for support of DT&E and OT&E. At the completion of these formal tests, control and management of the prototype will pass to the AFV LCSEC for use in maintenance of the AFV computer software components.

6.17.1.2 Automated Test Suites - The AFV system integrator will design and produce automated test suites for software testing at the system level. The test suites will include stress/overload tests and system degradation tests in addition to those tests needed to test software component according to specification.

6.17.1.3 Software Performance Evaluator - The system integrator will also design and produce automated software component performance, evaluation, and diagnostics programs for use in development, testing, and maintenance of AFV computer resources.

6.17.2 Facilities

6.17.2.1 Developmental Test & Evaluation (DT&E) - The AFV system integrator will provide automation and communications resources testing facilities for AFV contractors and for military participants.

6.17.2.2 Operational Test & Evaluation (OT&E) - The AFVTF will arrange for AFV OT&E units and facilities to include facilities for automation and communications resources testing by the integration contractor and selected software contractors.

6.17.3 Personnel

6.17.3.1 DT&E Personnel Requirements - Technical DT&E personnel requirements will be determined by the integration contractor and approved by the AFV PMO.

6.17.3.2 OT&E Personnel Requirements - User OT&E personnel requirements will be determined by the AFVTF. Contractor representation and support during OT&E will be coordinated by the integration contractor.

6.18 TEST SCHEDULES

Schedules for test planning and performance are presented in Figure 6-3. Some schedules are not firmly established and will be defined in later updates to this CRMP.

6.19 SUMMARY, TEST AND EVALUATION

Chapter 6 covers testing goals, policies, management responsibilities, methodologies, requirements, and schedules related to the development of the AFV automation and communications resources.

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Test Schedules

	87	88	89	90	91	92	93	94	95	96
PROOF OF PRINCIPLE										
Tech Base Demos	===									
Critical AFV Technologies			===							
Test/debug models/sims		===								
Phys/Analytical Sim/test			===							
EUT&E/CTE	===	===	===							
DEVELOPMENT/PROVEOUT										
Contractor testing				===	===					
Technical Tests & Eval						===				
Operational Tests & Eval						===	===			
IOT					*					
OT						*				
EUT&E				===	===					
PRODUCTION										
Production Quality Tests									===	

Figure 6-3

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CHAPTER 7 - PLAN FOR SUPPORT

7.1 INTRODUCTION

The Plan for Support Chapter, presents activities which must take place in order to effectively provide Computer Resources support Development Proveout and Production/Deployment of the AFV system. This Chapter also discusses the development of computer resources management to include the AFV Life Cycle Software Engineering Center(s) (LCSEC) and the support philosophy, the support organization, and responsibilities. Support activities necessary throughout the life cycle phases of the AFV program are defined. The support facilities are discussed as well as the means which will be used to maintain AFV system integrity. Configuration Management planning for the post deployment portion of the AFV life cycle is presented. Personnel and training requirements are identified. Testing activity for post deployment AFV is discussed. This Chapter of the CRMP defines the plan that will be established and followed in providing for the life cycle support of the AFV automation and communications resources.

7.1.1 SUPPORT PHILOSOPHY

Support of the AFV computer resources will be managed by the AFVTF. The LCSEC and the Automation and Communciations Resources Working Group (ACRWG) will assist the AFVTF in management of these life cycle support aspects. AFV candidate components or subsystems (such as SINCGARS, EPLRS, etc) already

under a Program Manager or Program Executive Office will retain management responsibility and will update their respective plans to support the AFV.

7.1.1.1 Plans To Establish Support Facilities - Plans to establish support for AFV automation and communication will be finalized prior to Milestone I/II. It is anticipated that AFV will require two LCSEC's; a VCOS LCSEC operated by TACOM and a B2C2 LCSEC operated by CECOM. Software engineering support for a vehicle defense, position navigation, embedded training, stand-alone training devices, fire and weapon control, automated logbook, communication control, fighting station, and special equipment control must be finalized by a work breakdown structure. Hardware (computer and communication) engineering support will be developed in a similiar manner.

7.1.1.2 Activities Required for LCSEC Support - The intense activities necessary to prepare an LCSEC facility to support the AFV are presented at Figure 7-1. These activities are described at Appendix H. It is planned that during Development Proveout (DPO), at least two LCSECs will be required to support Battalion and Below Command and Control (B2C2) development and integration and to support the AFV Vehicle Control and Operating System (VCOS).

7.2 SUPPORT ORGANIZATION

7.2.1 AFV Life Cycle Support

The phases throughout the AFV System's life cycle which will require LCSEC support are Development Proveout and Production/Deployment. The organization and relationship of the LCSEC to the AFVTF during these phases is shown in Figures 7-2 and 7-3.

7.2.2 Support Before Deployment

The Automation and Communications Resources manager for the AFVTF is the C3I Division. The C3I Division is responsible for AFV software support during all phases. Its organization is shown in Figure 3-1 in Chapter 3. The AFV software maintenance for systems prior to

Activities Required
for
Life Cycle Software Engineering Centers (LCSEC)
to Support the
Armored Family of Vehicles (AFV)

A. Document Mission Critical Computer Resources (MCCRs)
B. Identify Personnel/Technical skills Needed
C. Create a Library
D. Acquire Partial Software Personnel Crew
E. Identify Hardware and Software System Components
F. Identify System Support Hardware and Software
G. Acquire Remaining Personnel
H. Acquire Documentation/Technical Publications
I. Prepare or Update Software Support Plan
J. Familiarize Personnel with System Software Configuration
K. Prepare LCSEC Procedures
L. Define Space and Security Requirements
M. Prepare Test Cell
N. Acquire System and Support Items
O. System Installation
P. Develop and Conduct Integration Procedures
Q. Develop Configuration Management (CM) Plan Annex
R. Conduct system Hardware Training of Personnel
S. Conduct software Tests/Emulation
T. Center Operations
U. Continuity of Operations Planning
V. Administration Preparation

Figure 7-1

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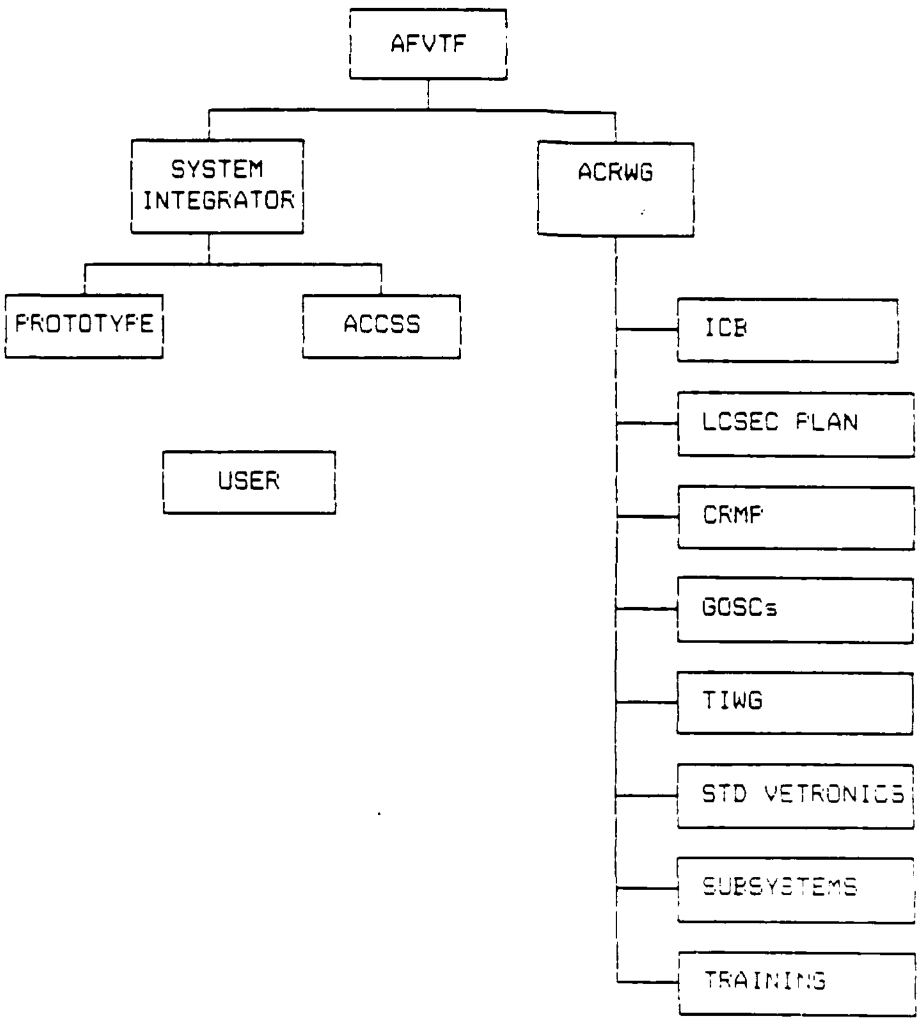
Support Organization
Proof of Principle and Development Proveout

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                          MS                                   MS
      |<---PoP---->|     I/II   |<--------DPO-------->|       III   |<-P/D-->|FIELD
RRC     87        88      89       90        91        92       93       94       95
```

Figure 7-2

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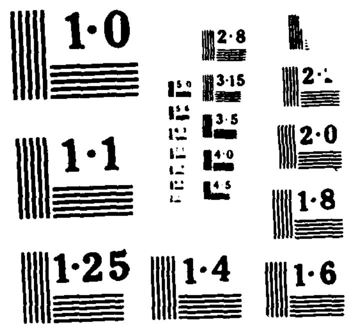
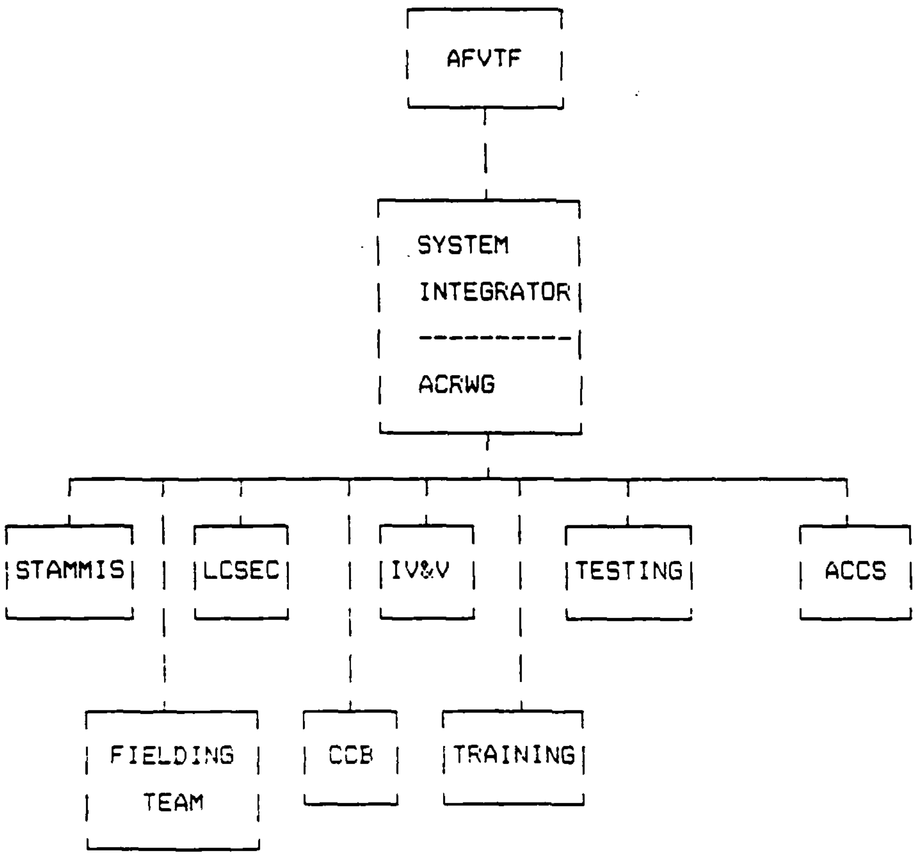
AD-A190 934 ARMORED FAMILY OF VEHICLES (AFV) AUTOMATION AND COMMUNICATION RESOURCE MA..(U) ARMORED FAMILY OF VEHICLES TASK FORCE FORT EUSTIS VA R D BUCKSTAD 3/4

UNCLASSIFIED 01 SEP 87 F/G 5/1 NL


1·0
2·8
3·15
3·5
4·0
4·5
2·0
1·1
1·8
1·25
1·4
1·6

Support Organization
Production/Deployment

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                          MS                                     MS
         |<---PoP---->|  I/II  |<-------DPO--------->|  III  |<-P/D-->|FIELD
RRC     87        88        89        90        91        92        93        94        95
```

Figure 7-3

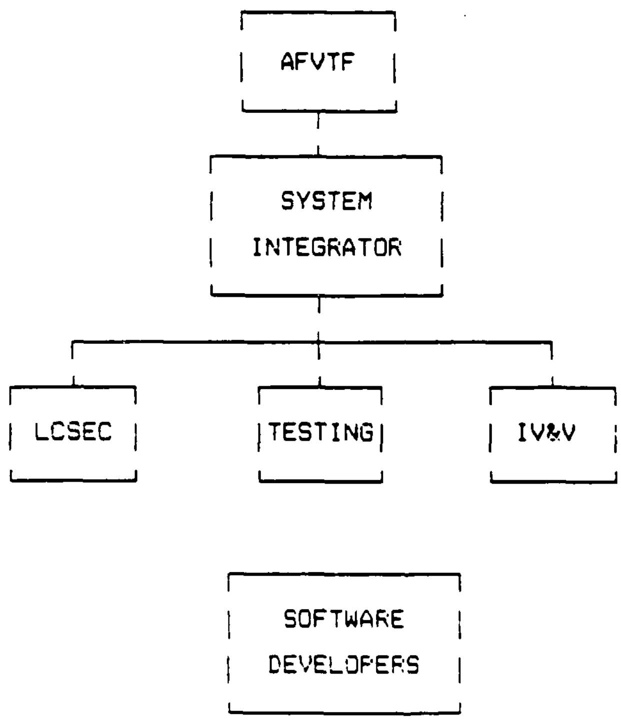
fielding (Development Proveout and Production/Deployment) is shown in Figure 7-4. This system will evaluate deficiencies, failures or additional requirements as identified by the User/Director during the developmental phases preceding fielding. As the figure depicts, the developer (normally the prime contractor) is responsible for correcting the failure or addressing the requirement.

7.2.3 Support During Testing

If the testers in a developmental/operational test (DT/OT, II, III) determine a failure of the system to meet requirements or specifications, they may generate a Test Incident Report (TIR). During this period the Combat Developer (TRADOC) may consider additional requirements for incorporation during a Pre-Planned Product Improvement (P3I) review that will be held following the system Production and Development. There is a very relevant point as concerns cost effectiveness during FSD (pre-production) when the design must be frozen so that the government and the contractor/developer may focus on the product to be produced. This is necessary to ensure the system's effectiveness to combat a new or changing threat environment. In the former case, the generation of a TIR will be processed through the AFV Director of Automation and Communication for consideration; and in the latter, the requirement will be staffed through the AFVTF offices. Should these offices determine that the need is survivability related, it becomes an AFV, Chief of Communication and Automation action. Otherwise, the failure report will be processed by another one of the paths described below.

Software Maintenance

Development Proveout and Production/Deployment

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                        MS                                   MS
      |<---PoP---->|  I/II  |<-------DPO--------->|  III  |<-P/D-->|FIELD
RRC     87        88       89       90       91       92       93       94       95
```

Figure 7-4

7.2.4 Steps in Software Reconfiguration

The following describes the steps involved in AFV Software Maintenance:

A. TRADOC or AMC identifies new requirement or upgraded capability. This change is passed on the Director, AFVTF.

B. Test deficiency or design deficiency manifests itself through Problem Description Report (PDR), Critical Design Review (CDR), or Engineering Change Proposal (ECP). Deficiency is identified to Director, AFVTF.

C. During the test phase, Test Incident Reports (TIRs) are prepared by the test activity. TIRs are forwarded to the AFVTF Deputy Director, Materiel Development; comments and recommended corrective action are forwarded to the Director, AFVTF or test sponsor who initiates the corrective action. The AFV LCSEC establishes the receipt, control, and assignment of responsibility for corrective action on TIRs. (AR 70-10).

D. AFVTF coordinates with the LCSEC to determine extent and impact of all TIR's. Director, AFVTF draws selectively upon resources as required.

E. AFVTF determines necessity and method of implementing change, e.g., PII, ECP, change to existing development contract. Changes will be limited to those considered absolutely essential for safe and effective system performance.

F. AFVTF monitors prime contractor to assure change is implemented. AFVTF is supported by the LCSEC, and other agencies during monitoring efforts.

7.2.5 Deployment Support

AFVTF LCSEC will provide technical software support during the deployment phase of the AFV life cycle according to Figure 7-5.

7.2.6 Post Deployment Support - The developer's Software Development Station (SDS) and simulation facility will be used to maintain the AFV Software until deployment. Following the deployment of AFV, the LCSEC will employ a multiuser host computer to support software changes and modifications for the AFV. Example of the steps that could be taken by the LCSEC depicted in Figure 7-6 are shown below:

A. The LCSEC host computer will centralize Configuration Management and keep a library of all program versions including source, object, and load modules. The source code will be loaded into files on the LCSEC host computer using magnetic tape or other compatible media.
B. Changes to the source code will be made using the LCSEC host computer program development environment.
C. New versions of source code will be controlled in the library.
D. Assemblers will translate the source code into object code.

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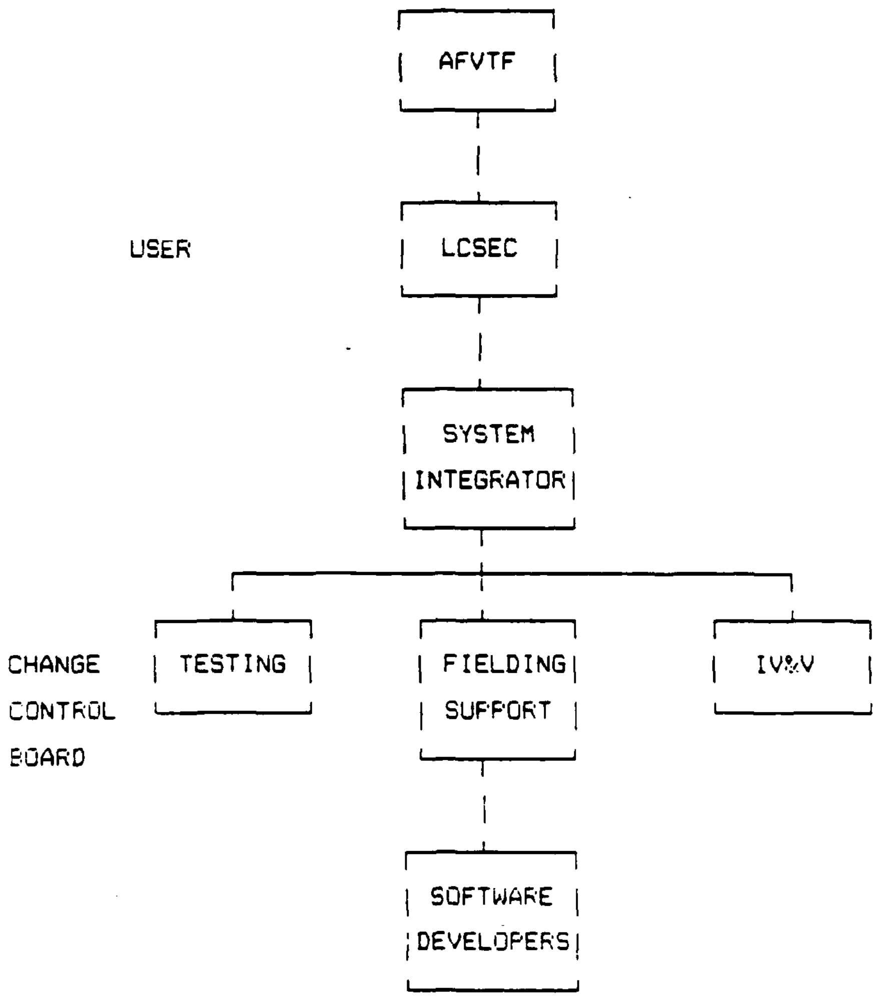
Software Maintenance
(Deployment)

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                          MS                                  MS
        |<---PoP---->|   I/II   |<-------DPO-------->|  III  |<-F/D-->|FIELD
RRC     87        88      89       90       91       92     93      94       95
```

Figure 7-5

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AFV LCSEC

Software Support Configuration

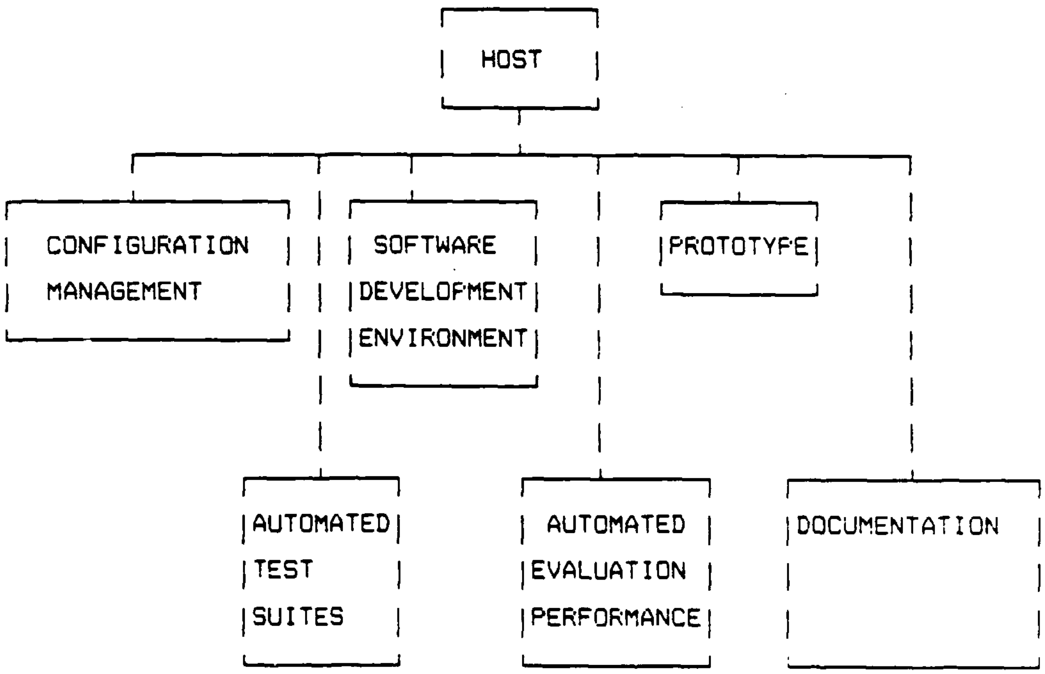

Figure 7-6

E. The object code is in the format required by the specific target computer.

F. A link program will resolve the entry points of the object modules.

G. The link process creates an executable load module.

H. The load module may be debugged on the LCSEC host computer using developmental software tools. This is only sufficient for unit testing since timing considerations would be different on the LCSEC host computer as compared to the actual target computers.

I. The load module may also be downloaded to various Microprocessor Development Stations (MDS), as needed.

J. The MDS provides real-time debugging capabilities for testing of the fully integrated systems.

7.2.7 Software Maintenance

The system for maintenance of AFV software includes repair of problems noted during development or following deployment of the AFV, follow-on additions, and routine updates to the system software. Regardless of the source of the software changes, all changes will be processed through the AFV LCSECs.

7.3 SUPPORT ORGANIZATION RESPONSIBILITIES

7.3.1 Project Management Office (PMO)

The to be designated AFV PMO is responsible for establishment and supervision of the AFV LCSECs. During Development Proveout the LCSECs will be operated by the system integrator. During

Production/Deployment the LCSECs will operate under the AFVTF with integrator support.

7.3.2 Life Cycle Software Engineering Center (LCSEC)

The AFVTF with support from other command elements will ensure that effective Life Cycle Software Engineering Centers are established and the following actions accomplished:

A. Prepare and maintain a software support plan responsive to AFV requirements.
B. Determine, acquire, and maintain required resources for support of the AFV.
C. Perform analysis of software and support software changes related to problems, system changes, requirements changes, doctrine changes, etc.
D. Develop system software change requirements.
E. Develop, design, implement, and document all software modifications.
F. Maintain documentation necessary to support existing fielded software and existing support software.
G. Distribute changes in accordance with the AFV Configuration Management Plan.
H. Comply with appropriate design standards, programming standards, and documentation standards

I. Test and perform evaluation of the impact of changes on the operational function.

J. Assist in user acceptance testing, including evaluation of operational suitability and operational effectiveness.

K. Maintain communications and procedures between the field and the support Center and provide guidance to the field on operation and employment of the AFV as related to software.

L. Develop system test and analysis software/hardware.

M. Develop and maintain simulators and emulators where required.

N. Develop and conduct training necessary to introduce a new software version.

O. Develop and distribute procedural, operational, training, and maintenance documentation, and special operating instructions.

P. Prepare, evaluate, and implement ECPs related to the support software or hardware required when changes to the AFV are approved.

Q. Provide configuration management of the software support system.

R. Coordinate with the Materiel Manager and TRADOC's Combat Development Support Managers to estaolish priorities for software support.

S. Coordinate with the AFV ILS Team on software maintenance support functions.

T. Participate on the Configuration Control Board (CCB), sub-boards for the AFV, and working groups.

U. Other: to be determined (TBD).

7.3.3 Training and Doctrine Command (TRADOC)

TRADOC is responsible for keeping the AFV LCSEC informed of all combat development related areas which might impact on the performance of AFV. Such changes, brought about by new doctrinal employment methods, technological advancements in target surveillance and navigation techniques, or the desire to utilize different configurations, should be coordinated by the Directorate with the AFV LCSEC for further analysis, evaluation, and implementation if directed by the AFV PMO. Additionally, the Directorate is responsible for providing definitions and guidance for establishment of standard scenarios required in support of testing.

7.3.4 Army Materiel Command (AMC)

AMC is responsible for keeping the LCSEC informed of all acquisition related areas which may impact on future development of automation and communications resources for the AFV.

7.3.5 Program Executive Officer (PEO)

7.4 DOCUMENTATION SUPPORT

Documentation support for the AFV software must be maintained at the system and susbsystem levels. Automatic documentation support must be made available to AFV system developers.

7.4.1 System Documentation

System documentation necessary to support AFV will include all documentation called for by DOD-STD-2167:

A. Software Requirements Specification
B. Software Product Specification
C. Software Top Level Design Document
D. Software Detailed Design Document
E. Software Test Plan
F. Software Test Procedures
G. Software Test Reports
H. Software Quality Assurance Plan
I. Software Development Plan
J. Summary Reports from hardware and software Critical Design Reviews
K. Software test plans and procedures used for unit and/or integration testing on AFV software during development.
L. Results and procedures from Software tests.
M. Interface Control Documents (ICD)
N. System Operator's Manual
O. All other records/reports from CM procedures such as (but not limited to) reports from Functional and Product Configuration Audits, Formal Qualification Review, Configuration Item Review; any documents from Configuration Status Accounting, Baseline Management, of Software Change Status Reports.
P. Other: TBD

7.4.2 Subsystem Documentation

All Subsystems require the following documentation:

A. Listing of compiled software software including source language statements and comments with resulting object machine instructions.

B. Flowcharts, HIPO's, and/or any other logic diagrams and graphic representation (Both Type level and detailed design documents).

C. Descriptive abstracts at the beginning of the executable code including inputs, outputs, and function or task, list of other components called.

D. Cross-reference listings.

E. Load maps describing the format, method, and location where the various components are loaded in the system's computer.

F. User/Maintenance Manuals.

G. All documentation on all Simulators used for the AFV.

H. Other: TBD

7.5 COMPOSITE SYSTEM INTEGRITY

The AFV LCSEC will be responsible for the integrity of the AFV computer resources and will maintain positive control of the following as a minimum.

A. Computer Storage Utilization.

B. Computer Program Operating Time and Priorities.

C. Computer Program Interface Techniques.

D. Computer Baseline Integrity.

E. Utilization of Computer Modules and Peripherals.

7.6 CONFIGURATION MANAGEMENT

Configuration Management is the application of technical and administrative direction and surveillance to the identification and documentation of functional and physical characteristics, the control of changes to those characteristics, and the recording and reporting of change processing and implementation status. The primary configuration management functional areas include:

A. Configuration Identification
B. Configuration Control
C. Configuration Status Accounting
D. Configuration Audits and Reviews
E. Document Control
F. Other: TBD

These procedures, when carefully applied, will provide assurances that the AFV computer resources will attain their required performance, schedule, operational efficiency, logistic support, and readiness goals.

7.6.1 Configuration Identification

Configuration identification is established by the currently approved technical documentation of configuration items (CI). Configuration identification documents include all those necessary to provide a full technical description of the CI characteristics that require control in the AFV system. This includes specifications, drawings, listings, charts, and other approved design documents.

7.6.2 Configuration Control

The configuration of AFV software is controlled by: Establishing its baseline (configuration identification); controlling all changes from that baseline through evaluation, classification, quality control, test, and

validation; and assuring that the hardware and software match the current configuration identification including approved waivers and deviations. A software change or modification is classified as an error correction, system refinement, new requirement, or interoperability interface.

A. Error Correction is performed on latent defects (problems not discovered during development) and functional defects (problems discovered during operational use).

B. System refinement usually deals with optimizing programs, improving system performance, and incorporating technological advances. Included in this category, are evolutionary modifications to applications software in response to evolving or changing tactical doctrine and threat.

C. New requirements are program modifications which result from major changes or new application. Changes categorized as new requirements are to be managed as Product Improvement Programs (PIPs) in accordance with AR 70-15.

D. Interoperability interface configuration changes or modifications are those affecting the design baseline of those systems controlled by Battlefield Interface Implementation Plans, Interoperability Design Standards, or Technical Interface Design Plans.

7.6.3 Configuration Status Accounting

The status accounting function provides for the recording and reporting of the information that is needed to make configuration identification control for AFV workable. The technical documentation that will be recorded includes:

A. The configuration identification (baseline)
B. Approved changes to the configuration and the implementation status of such changes
C. Contractual information required for each CI and contractor identification
D. Proposed changes to the configuration and the status of such changes.

7.6.4 Configuration Audits and Reviews

Configuration audits and reviews are performed to verify that a completed Configuration Item (CI) conforms to its specifications, drawings, and other contractual requirements. The following configuration audits and reviews are required:

7.6.4.1 Functional Configuration Audit (FCA) - The FCA is conducted to verify a completed CI will perform as intended.

7.6.4.2 Physical Configuration Audit (PCA) - The PCA is conducted to verify the contractor's proposed baseline accurately and completely describes the as built CI.

7.6.4.3 Formal Qualification Review (FQR) - The FQR is conducted to identify test reports and test data, to verify test reports and test data, and to establish that the demonstrated performance of a CI (as documented by these tests) is in compliance with the CI's Development Specification.

7.6.4.4 Configuration Item Verification Review (CIVR) - The CIVR is conducted to verify that the system has been produced and tested in accordance with the current Product Configuration Identification (PCI).

7.6.5 Configuration Control Board

The Configuration Control Board and the Automation and Communications Resources Working Group AFV are the primary AFVTF configuration management organizations. Their responsibilities are outlined below.

7.6.5.1 Configuration Control Board (CCB) - The CCB is the primary medium for managing hardware and software change control and release. For the purpose of controlling and validating software changes/modifications, the CCB is responsible for determining the validity of all proposed changes/modifications to the AFV, approving/disapproving these proposals, and classifying any that are approved. The CCB thus maintains the integrity of the baseline. CCB implementation will occur prior to Milestone III. Membership is in the CCB includes as a minimum:

A. Selected AFVTF Representatives
B. AFVTF LCSEC Representative
C. AMC Representatives
D. TRADOC Representatives
E. Other Functional areas as required

7.6.5.2 Automation and Communications Resource Working Group (ACRWG) - With respect to CM, the ACRWG ensures that the computer resource planning is reflected in the CRMP adequately addresses CM requirements determined by the AFVTF.

7.6.6 Deficiency/Improvement Reporting and Processing

All system software problems will be reported on a Quality Deficiency Report (QDR). A QDR will be handled either by routine, urgent or emergency.

7.7 PERSONNEL REQUIREMENTS

Identified below are the preliminary AFV LCSEC personnel requirements needed in order to support the computer equipment and computer programs of the AFV.

7.7.1 Project Engineer (PE)

The PE (to be designated) will become knowledgeable of the overall system operation and familiar with the software content and capabilities. He will be responsible for assigning duties to AFV programmers and will supervise them during software updates and modifications. He or she will produce the required documentation and other periodic reports during the course of AFV Production/Deployment phases.

7.7.2 Other Personnel

Other Personnel requirements will be identified in the planning for implementation of the AFV LCSEC (See Appendix H).

7.8 TRAINING REQUIREMENTS

7.8.1 AFV LCSEC Training

As required, AFV LCSEC personnel will receive hardware and software training as soon as possible according to the activities required for LCSEC to support the AFV. On the Job Training (OJT) is the least preferred method of training provided acceptable formal training facilities exist, Personnel requiring extensive software training require AFV C3I Division Chief approval.

7.8.2 User Training

At this time user training will be incorporated in the AFV Individual Collective Plan, published separately.

7.9 TESTING

Testing support is covered in Chapter 6.

7.9.1 Testing Policy

Developmental and Formal testing policy will be developed, refined, and used for testing of software corrections and maintenance.

7.9.2 Independent Verification and Validation (IV&V)

Independent Verification and Validation will be accomplished by the system integrator.

7.10 TRANSFER OF PROGRAM MANAGEMENT RESPONSIBILITY

Due to the continuing developmental nature of the AFV system, it is expected that the AFVTF will evolve into a Program Executive Office (PEO) and continue as the overall developer/manager.

7.11 SYSTEM MODIFICATIONS

AFVTF LCSEC will provide system modification and enhancement support throughout all phases of the AFV life cycle.

7.11.1 Introduction of Modifications

Once a modification has been approved, users will be provided with the required changes. To accomplish this function, four processes must occur:

- o The Replication Process
- o The Shipment Process
- o The Installation Process
- o The Collection Process

7.11.2 The Replication Process

Upon completion of verification, validation, and testing of all changes, the software or hardware will be produced in the required amounts for distribution and installation in the AFV. Special documentation, if needed, will be produced for packaging with the replacement software component.

7.11.3 The Shipment Process

Distribution to the field will be accomplished in unit sets IAW approved AFV fielding strategy. Critical/Emergency distributions of master change packages will be made to AFV PMO LCSEC field support teams for local reproduction and installation.

7.11.4 The Installation Process

Installation of routine software changes in individual AFV's will be accomplished at the unit maintenance level either by installation of a replacement/add-on hardware component or by use of an externally connected software update capability.

7.11.5 The Collection Process

An automated record of the software versions for each AFV will be collected and forwarded to the AFVTF LCSEC for the purpose of configuration management.

7.12 LIFE CYCLE COSTS

Automation and communication resources will be costed in the following areas: development, production, fielding, and materiel and personnel sustainment. Cost data must differentiate between AFV required and AFV support. AFV required costs are those costs directly required for AFV. AFV support costs are based on those systems which would be fielded by the Army without AFV (i.e. SINGCARS, MSE, AFATDS, etc).

7.12.1 Development Costs

7.12.2 Production Costs

7.12.3 Fielding Costs

7.12.4 Materiel Sustainment Costs

7.12.5 Personnel Costs

7.13 FUNDING

AFVTF will establish funding priorities base on AMC and TRADOC recommendations. AMC and the Department of the Army have funding responsibility. AMC will be responsible fo obtaining technology base for AFV research and development, operational maintenance (Army, DMA) for engineering and installation and procurement. Department of the Army will accomplish funding actions required for fielding support.

7.14 TECHNOLOGY ASSESSMENT

The purpose of the AFV Technology Assessment is three-fold. First, it is designed to identify technology base (6.1-6.3A) and product managed projects applicable to AFV fielding and PII. Second, it is designed to identify dollars and resources required to field these projects or insert the technology into the AFV. The Mission Area Materiel Plan (MAMP), Long Range Research Development Activities Plan (LRRDAP) and Program Objective Memorandum (POM) are to be effected and tailored to AFV. TRADOC and AMC have primary responsibility to ensure Army dollar resource plans reflect AFV objectives.

The third purpose of the technology assessment is to identify projects which are not applicable to AFV. The Technology Assessment in Volume IX for the Task Force products will be continually maintained during the AFV life cycle. AMC has primary responsibility for maintaining the AFV Technology Assessment.

7.15 SUMMARY, PLAN FOR SUPPORT

Chapter 7 is the support plan for AFV automation and communications resources support throughout the life cycle of the AFV.

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APPENDIX A

ACRONYMS AND ABBREVIATIONS

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ACRONYMS AND ABBREVIATIONS

ACCS	Army Command and Control System
ACCSS	Army Command and Control Subordinate Systems
ACRWG	Automation and Communications Resource Working Group
ADA	Air Defense Artillery
Ada	DOD Standard Programming Language
ADEA	Development and Evaluation Agency
AFV	Armored Family of Vehicles
AFVTF	AFV Task Force
AMC	Army Material Command
AMCCOM	Armament, Munitions, and Chemical Command
AMSAA	Army Materiel Systems Analysis Activity
ARDEC	Armament Research and Development Engineering Center
ARI	Army Research Institute
ARO	Army Research Office
ASAS	All Source Analysis System
AVSCOM	Army Aviation Systems Command
AVSRDA	Aviation Systems Research and Development Activity
B2C2	Battalion & Below Command and Control System
BIT	Built In Test
BITE	BIT Equipment
BMS	Battlefield Management System
BRDEC	Belvoir Research and Development Engineering Center
BRL	Ballistic Research Laboratory
C2	Command and Control
C3I	C2, Communications, Intelligence
CAC	Combined Arms Center
CACDA	Combined Arms Combat Development Activity
CCB	Configuration Control Board
CCS	C2 Systems
CD	Combat Developer
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CECOM	Communications and Electronics Command
CEOI	Communications Electronics Operating Instructions
CM	Configuration Management
CI	Configuration Items
CIVR	Configuration Item Verification
COMSEC	Communications Security
CPDP	Computer Program Development Plan
CRDEC	Chemical Research and Development engineering Center
CRISD	Computer Resources Integrated Software Support Document
CRMP	Computer Resource Management Plan
CSC	Computer Software Component
CSCI	Computer Software Configuration Item
CSS	Combat Service Support
CSSCS	Combat Service Support Control System

ACRONYMS AND ABBREVIATIONS
CONTINUED

DA	Department of the Army
DBDD	Data Base Design Document
DE	Directed Energy
DEW	Directed Energy Weapon
D/P	Development Prove Out Phase
DOD	Department of Defense
DT	Demonstration Test
DT&E	Demonstration Test and Evaluation
DT&OT	Developmental Test/Operational Test
ECP	Engineering Change Proposal
EPLRS	Enhanced PLRS
ETAS	Elevated Target Acquisition System
ETDL	Electronic Technology and Devices Laboratory
ETL	Engineering Topographic Laboratories
FAAC2I	Forward Area Air Defense Command, Control Intelligence System
FCA	Functional Configuration Audit
FIST	Fire Support Team
FQR	Formal Qualification Review
FRAGO	Fragmentary Order
FS	Fire Support
FSD	Full Scale Development
FSED	Full Scale Engineering Development
FV	Fighting Vehicle
GFE	Government Furnished Equipment
GOSC	General Officer Steering Committee
HCI	Hardware Configuration Item
HDL	Harry Diamond Laboratory
HEL	Human Engineering Laboratory
HFE	Human Factors Engineering
HFTB	Human Factors and Training Board
HOL	High Order Language
HSC	Health Services Command
ICB	Interface Control Board
IEW	Intelligence Electronic Warfare
ILS	Integrated Logistics Support
ILSP	Integrated Logistics Support Plan
INSCOM	Intelligence and Security Command
IOT	Initial Operational Test
IV&V	Independent Verification and Validation
JMSNS	Justification for Major System New Start
JTIDS	Joint Tactical Information Distribution System

ACRONYMS AND ABBREVIATIONS CONTINUED

LABCOM	Laboratory Command
LCSEC	Life Cycle Software Engineer Support Center, Activity or Facility
LCSS	Life Cycle Software Support
LOGCEN	Logistics Center
LOS AD	Line of Sight, Air Defense
LOS AT	Line of Sight, Anti-Tank
LRU	Line Replaceable Unit
MANPRINT	Manpower and Personnel Integration
MAPS	Mobile Azimuth Positioning Systems
MCCR	Mission Critical Computer Resources
MCS	Maneuver Control System
MD	Materiel Developer
MDS	Microprocessor Development Stations
MEP	Mission Equipment Package
MICOM	Missile Command
MS I/II/III	HQ DA directed Milestones
MSE	Mobile Subscriber Equipment
MSC	Major Subordinate Command
NATO	North Atlantic Treaty Organization
NBC	Nuclear, Biological, Chemical
NLOS	Non Line of Sight
OPSEC	Operational Security
OT	Operational Test
OTEA	Operational Test and Evaluation Agency
OT&E	Operational Test and Evaluation
O&O	Operational and Organization (Plan)
P3I	Preplanned Product Improvement
PCA	Physical Configuration Audit
PCI	Product Configuration Identification
PDL	Program Design Language
PDR	Preliminary Design Review
	Problem Description Report
PE	Project Engineer
PEO	Program Executive Officer
PIP	Product Improvement Program
PLRS	Position Location Recording System
PM	Program Manager
PMCS	Program Management Control System
PMD	Program Management Documents
PMO	Program Management Office
	Project Mangement Office
POC	Point of Contact
POP	Proof of Principle

ACRONYMS AND ABBREVIATIONS
CONTINUED

QDR	Quality Deficiency Report
ROC	Required Operational Capabilities
RSTA	Reconnaissance Surveillance Target acquisition
SAPPER	AFV Engineer Vehicle
SAVA	Standard Army VETRONICS Architecture
SCI	Software Configuration Item
SDDD	Software Detailed Design Document
SDP	Software Development Plan
SDR	System Design Review
SDS	Software Development Station
SETA	Systems Enginnering and Technical Assistance
SIGCEN	Signal Center & School
SINGCARS	Single Channel Ground Airborne Radio
SITREP	Situation Report
SOW	Statement of Work
SPS	Software Product Specification
SQA	Software Quality Assurance
SRR	System Requirements Review
SRS	Software Requirement Specification
SSC	Soldier Support Center
SSR	Software Specification Review
STAMMIS	Standard Army Multicommand Management Information Systems
STD	Software Test Description
STLDD	Software Top Level Design Document
STP	Software Test Plan
STR	Software Test Reports
TACOM	Tank and Automotive Command
TECOM	Test and Evaluation Command
TEMP	Test and Evaluation Master Plan
TEMPEST	Telecommunications Electronic Materiel Protected From Emanating Spurious Transmissions
TMDE	Test Maintenance Diagnostic Equipment
T&E	Test and Evaluation
TIR	Test Incident Report
TIWG	Test and Integration Working Group
TCATA	TRADOC Combined Arms Test Activity
TRAC	TRADOC Analysis Command
TRADOC	Training and Doctrine Command
TROSCOM	Troop Support Command
USAISC	U.S. Army Information Systems Command
USALEA	U.S. Army Logistics Evaluation Agency
VCOS	Vehicle Control and Operating System
VDD	Version Description Documents
VETRONICS	Vehicle Electronics
VIDS	Vehicle Integrated Defense System
WBS	Work Breakdown Structure

APPENDIX B

AFV VEHICLE SUMMARY

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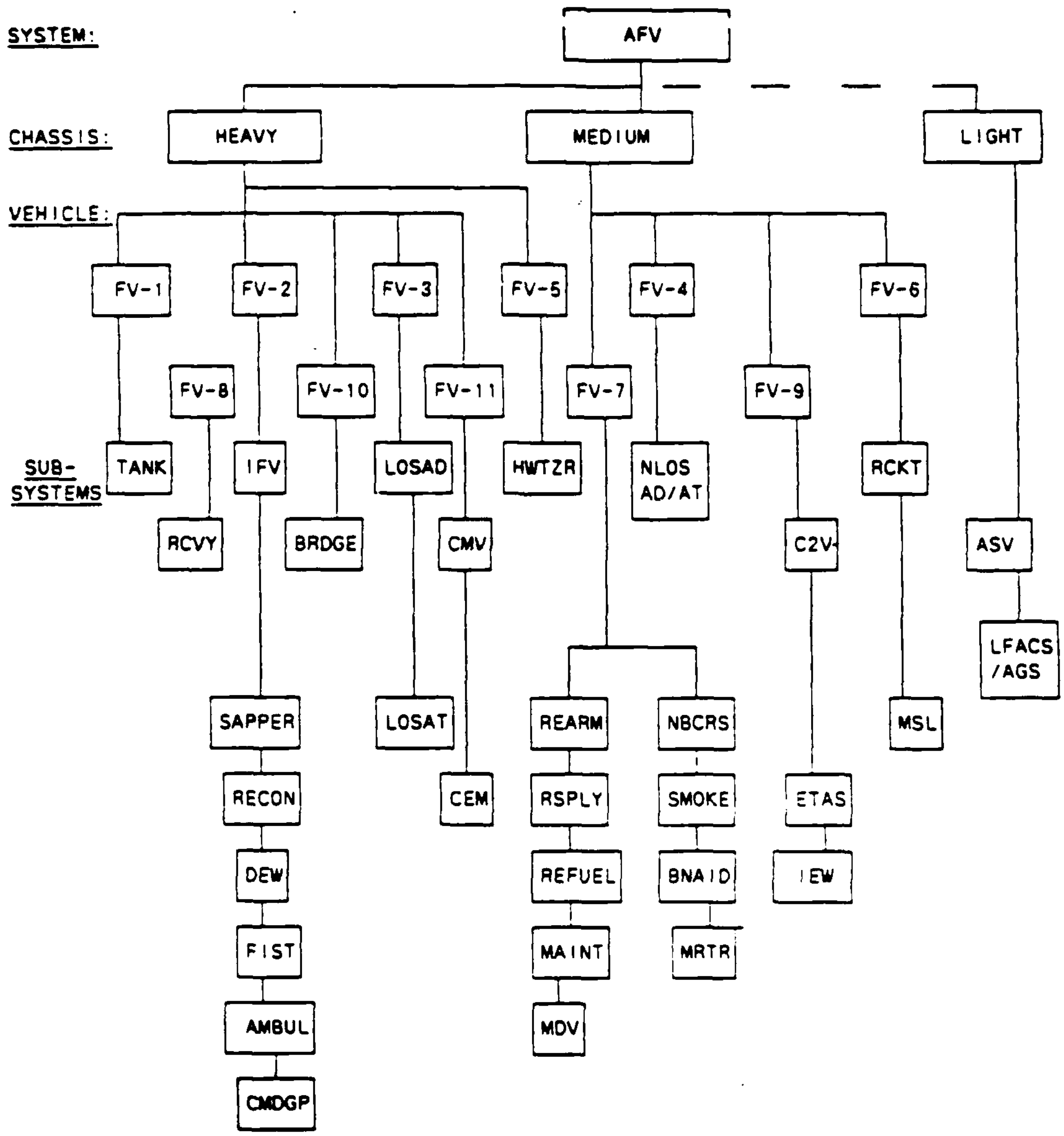
ARMORED FAMILY OF VEHICLES (AFV)

VEHICLE SYSTEM SUMMARY

VARIANT	NOMENCLATURE	MISSION	EXISTING VEHICLE*
ASSAULT FV-1	ATTACK VEHICLE	TANK	M60A1-A3, M1, M1A1, M48A5
FV-2	ASSAULT VEHICLE	INFANTRY, SAPPER AMBULANCE, FISTV, COMMAND GROUP, RECON, DEW	BFV W/TOW OR AAWS-H; M113A1-A3; M981 FISTV, AMBULANCE
FV-3	ASSAULT FIRE VEHICLE	LOS-AD LOS-AT	KEM ON CHASSIS; M741 W/M163 VULCAN; LOS FH ON M-2/MLRS OR M113; DUSTER M42A1; M901
FV-11	ASSAULT MOBILITY VEHICLE	COMBAT MOBILITY/ OBSTACLE BREACH	COV; M728 CEV; BULL DOZER; TANK W/ROLLER/PLOW
FV-10	ASSAULT BRIDGE	GAP CROSSING	AVLB
ASSAULT SUPPORT FV-4	ASSAULT FIRE SUPPORT-MISSILE	ANTIARMOR/ANTIAIR	FAAD (NLOS) ON MLRS CHASSIS; LRAT ON MLRS CHASSIS.
FV-5	ASSAULT FIRE SUPPORT GUN	HOWITZER	AFAS; HIP; M109A2-A3.
FV-7	ASSAULT SUPPORT VEHICLE	NBC RECON, REARM, REFUEL, RESUPPLY, MAINTENANCE, SMOKE GENERATION, MORTAR, AMBULANCE, MINE DISPENSER	M113 M992 FAASV; M548; M501A3 TPU; M49A2C; HEMTT TANKER M548, M35A2C; 5 TON; HEMTT CARGO M113; M578; T10128 M1059; M113 M106 A1-A2; M125 A1-A2 M113; HMMWV; M577 AID STA GEMSS; M548 W VOLCANO
FV-8	ASSAULT SUPPORT VEHICLE RECOVERY	BATTLEFIELD REPAIR & EVACUATION	M88A1-A2; M578
BATTLE FV-6	BATTLE FIRE SUPPORT VEHICLE	DEEP BATTLE SUPPORT MULTIPLE LAUNCH ROCKET	MLRS M270
FV-9	C⁴ VEHICLE	C²; ETAS; IEW	AN/MLQ-34 TACJAM; AN/MSQ-103C TEAM PACK; AN/TSQ-114B TRAIL-BLAZER; M577A1-A2; M113; AN/TPS-25; AN/TPS-58; AN/PPS-5.

* AFV will replace

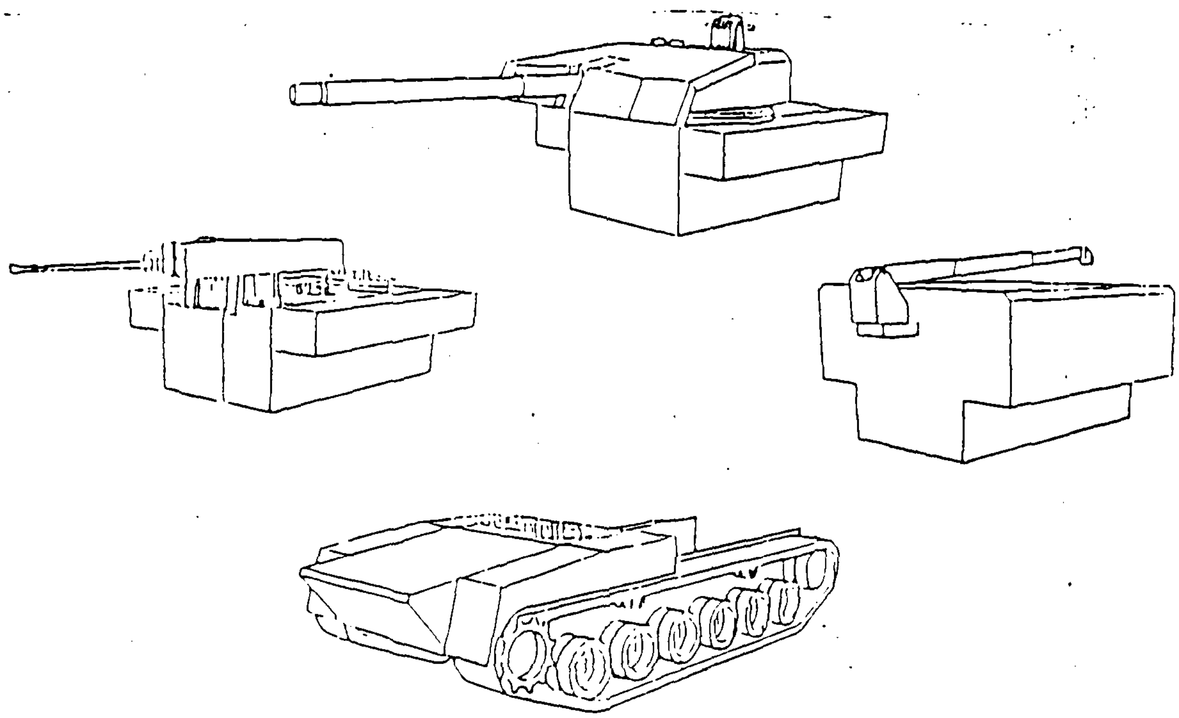
THE ARMORED FAMILY OF VEHICLES SYSTEM
OVERVIEW



B.2

AFV MODULARITY CONCEPT

ARMORED FAMILY OF VEHICLES SYSTEM



HEAVY CHASSIS & THREE CONCEPTUAL SUB-SYSTEMS

B.5

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ARMORED FAMILY OF VEHICLES (AFV) AUTOMATION AND

COMMUNICATION RESOURCES WORKING GROUP

(ACRWG)

CHARTER

ARMORED FAMILY OF VEHICLES TASK FORCE

DAMO-AFV-M

FORT EUSTIS, VIRGINIA 23602-5597

AUTOVON 927-1465/66

COMM (804) 878-1465

Appendix C
of the AFV Computer Resource Management Plan (CRMP)

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1. PURPOSE

To formally establish the AFV Automation and Communications Resources Working Group, hereafter referred to as the ACRWG. The primary purpose of the ACRWG is to provide a forum for direct communication in accomplishing the objectives and responsibilities outlined in paragraphs 4 and 5. This charter will be reviewed annually on its anniversary date for necessary revisions.

2. REFERENCE DOCUMENTS

a. Resource Management Documents:

(1) DOD Directive 5000.29, Management of Computer Resources in Major Defense Systems, 26 Apr 76.
(2) AR 1000-1, Basic Policies for System Acquisition, 1 May 83
(3) AR 70-1, System Acquisition Policy and Procedures, 12 Nov 86.
(4) AR 71-9, Material Objectives and Requirements, 6 Sep 85.

b. AFV Documents: A complete listing of applicable Program Management Documents (PMD), per AR 70-1, is provided in Volume I, Executive Summary report of the AFV program.

3. MEMBERSHIP

The AFV ACRWG membership includes representatives of the combat developer, material developer, development and operational testers and evaluators, and the designated post-deployment support activity. A full listing of the member organizations is presented in Figure C-1. A roster of the designated individual members is provided in Annex 1, of this document, along with their mailing address and telephone number.

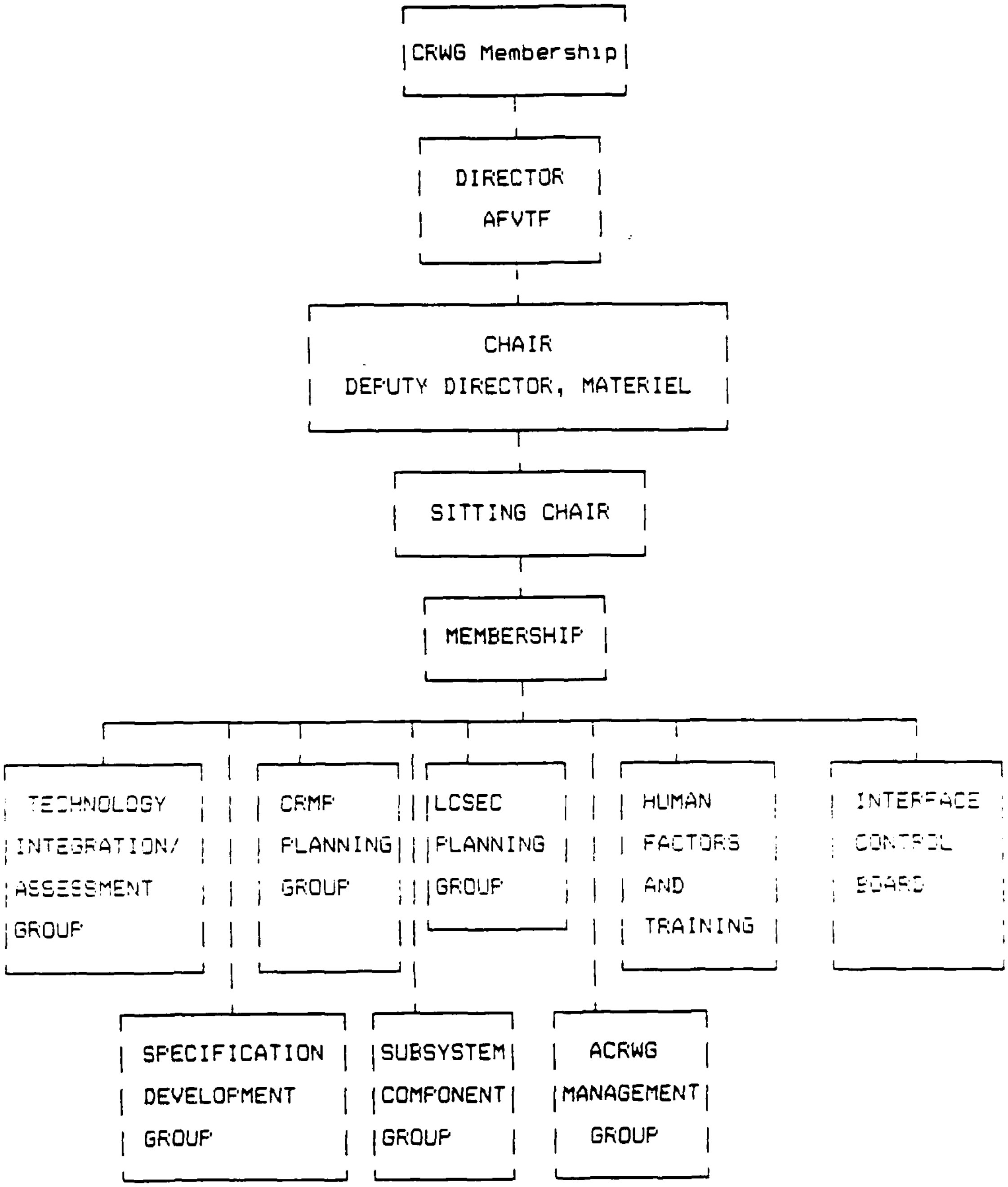
CRWG Membership
DIRECTOR AFVTF
CHAIR DEPUTY DIRECTOR, MATERIEL
SITTING CHAIR
MEMBERSHIP
TECHNOLOGY INTEGRATION/ ASSESSMENT GROUP
CRMP PLANNING GROUP
LCSEC PLANNING GROUP
HUMAN FACTORS AND TRAINING
INTERFACE CONTROL BOARD
SPECIFICATION DEVELOPMENT GROUP
SUBSYSTEM COMPONENT GROUP
ACRWG MANAGEMENT GROUP

Figure C-1

Changes in membership shall be made by the participating organizations in a formal notification to the ACRWG chair. The chairmanship of the ACRWG is vested in the Deputy Director, Materiel Development who is designated as the Automation and Communication Resource Manager for AFV managed systems and, as such, reports directly to the Director, Armored Family of Vehicles Task Force.

4. OBJECTIVES

The ACRWG provides a forum for the review and resolution of computer resource issues that may impact the acquisition, deployment, and support of the AFV. The specific objectives of the ACRWG are:

1) Maximize commonality and modularity across the AFV fleet. Support AirLand Battle doctrine and principles.
2) To improve the acquisition management of automation and communication resources for the AFV from subsystem through family levels.
3) To increase the visibility of computer and communication resources in the overall life cycle of the family.
4) To decrease the proliferation of unwarranted automation and communication resources in the Army inventory.
5) To increase the standardization of automation and communication resources by making maximum use of standard product line resources.
6) To promote the use of approved HOL, compilers, and other software tools in the system.
7) To assist the Director, AFVTF in initiating early tasks and activities that are prerequisites to the development and test functions of the AFV.

8) To assist the Director in ensuring compliance with DA policy, procedures, plans, and standards established for the acquisition of computer resources.

9) To facilitate preparation, review, and approval of the system's CRMP.

10) To eliminate unnecessary redundancy in testing.

11) To ensure that the integration of AFV Management Plans.

12) To facilitate trainer/materiel developer coordination in the development of appropriate training programs (e.g., New Equipment Training (NET), Individual Collective Training Plans (ICTP).

13) To assure the timely turnover of the system to the using command and an orderly transition to the post-deployment support activities.

14) To ensure interoperability and compatibility between AFV and other automated and communications systems required under the ACCS, aviation other programs.

15) Support, plan, recommend actions for vehicle electronic integration.

16) Integrate communication and command and control systems in support of AFV.

17) Provide necessary interaction with the AFV Test Integration working group, logistics and MANPRINT working groups, review associated plans.

18) Facilitate the integration of Built In Test (BIT) into planned AFV diagnostic capabilities. Plan for required Test Maintenance Diagnostic Equipment (TMDE). Strive for commonality and design for testability.

19) Strive for Common Soldier/Machine Interfaces.

20) Capture mission unique requirements and equipment into the AFV program.

21) Support AFV Proof of Principle Phase. Capture Operational and Technical Demonstration data of AFV candidate components and subsystems.

22) Maintain AFV Technology Assessment.

5. <u>RESPONSIBILITIES</u>

The ACRWG, when authorized by the Director, is responsible to:

a. Prepare, coordinate, and update, as necessary, the following items:

1) A complete CRMP for the AFV, which will be continually updated throughout the AFV life cycle.

2) Draft computer Engineering Support Agreements for the Director.

3) CDRLs for acquisition of the system's computer resources.

4) Computer Resource Management (CRM) sections of specifications.

5) CRM and Communications technical issues.

6) Compliance checklist of non-negotiable Communication and CRM items.

7) Updated AFV management plans to ensure automation and communication resources are accurately portrayed and receive necessary emphasis.

8) AFV Technology Assessment updates.

9) AFV component or subsystem test reports and milestone revisions.

b. Advise the Director and Task Force on general policy matters and on specific computer and communication resource issues applicable to the family.

c. Provide recommendations and advice to the Director on communication and computer resources technology.

d. Review the system computer resources activities for compliance with provisions of applicable DoD/DA policies and procedures.

e. Conduct impact assessments and analyses for the Director in both technical and managerial areas relating to automation and computer resources of the AFV.

f. Coordinate and take appropriate action to ensure candidate AFV components or subsystems are properly considered in the AFV program. Identify real or potential problem areas.

6. <u>PROCEDURES</u>

The ACRWG will be convened at the discretion of the ACRWG Chair. Meetings will usually occur three times yearly. ACRWG meetings are usually one or two days' duration. They are working meetings, where plans and schedules are prepared, coordination meetings, where plans prepared by members or ACRWG subcommittees are integrated into the overall system; or a combination of the two. See Annex 4.

7. <u>DISTRIBUTION</u>

Dissemination of material generated by the ACRWG will be accomplished by the chairman in accordance with a distribution list coordinated with the Program Manager. Minutes of ACRWG meetings will, as a minimum, be distributed to each of the member agencies within ten working days of the meeting. The AFV ACRWG Mailing List is provided in Appendix C.

8. <u>ACRWG Charter Administration.</u> The charter will be maintained as Appendix C of the Computer Resources Management Plan by the AFV Task Force and can function as a stand-alone

document. Recommended changes are encouraged. Mail recommended changes on DA Form 2028, Recommended Changes to Publications or equivalent directly to the AFV Task Force, DAMO-AFV-M, Fort Eustis, VA 23604-5597.

C.8

ANNEX 1

AFV ACRWG Membership List

Name	Organization (Office)	Address w/Zip Code	Telephone (AV & Comm)

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AFV CRMP — 18 AUG 87
VOLUME XIV — APPENDIX C

AFV AUTOMATION & COMMUNICATIONS WORKING GROUP MEMBERS

Command, Office	Points(s) of Contact	Location	Av/ Comm/ Ext1/Ext2
AFVTF, DA DAMO-AFV-M (CA)	Maj Robert D. Buckstad (ACRWG, Project Officer)	10th & Jackson Ft. Eustis, VA 23604-5597	Av: 927/ (804) 878 1465/1466
AMC, HQ AMCDE-AT	Mr. James Fong Mr. Jack Byers	5001 Eisenhower AvenueAlexandria, VA 22333-0001	Av: 284/ (202) 274 9711/9714
AMSAA AMXSY-C	TBD	Aberd Prv Gd, MD 21005	Av: 298/ (301) 278 /
ARDEC SMCAR-FSE-BV	Mr. Larry L. Yung	Picatinny Arsenal Dover, NJ 07806-5000	Av: 880/ (201) 7947/
ARMSCH ATSB-CD-ML	Cpt Dave Pride Cpt Steve C. Pappas	Ft. Knox, KY 40121-5000	Av: 464/ (502) 624 1750/5525
CAC ATZL-CAC-A	Maj Oscar Chappel	Ft. Leavenworth, KS 66027-5300	Av: 552/ (913) 684 4786/4283
CAC ATZL-CAC-CD	Maj Mike Hawrylak	Ft. Leavenworth, KS 66027-5300	Av: 552/ (913) 684 3137/2035
CAC ATZL-CAM-I	Mr. Ben Stutler Mr. Robert Buckingham	Ft. Leavenworth, KS 66027-5300	Av: 552/ (913) 684 2235/2096
CECOM AMSEL-RD-[illegible]	Dr. Robert Christian Mr. Schoening, Mr. Mondrick	Hexagon Building Ft. Monmouth, NJ 07703-5000	Av: 995/ (201) 544 [illegible]
CECOM AMSEL-RD-[illegible]	Mr. Mike Ayers Mr. [illegible]	Hexagon Building Ft. Monmouth, NJ [illegible]	Av: 995 [illegible] 544 [illegible]
ETDL SLCET-[illegible]	Maj Kevin Logan Mr. Ed [illegible]	Hexagon Building Ft. Monmouth, NJ 07703-5302	Av: 995 [illegible] 544 [illegible]
ETL CEETL-TD-C	CPT William Fosnev Office: CEETL-TD-S, Alt	Ft. Belvoir, VA 22060-5546	Av: 345/ (202) 355 2791/2792
HEL SLCHE-CC	Cpt(P) Dick Koffrinke	Aberd Prv Gd, MD 21005-5001	Av: 298/ (301) 278 5946/
LABCOM AMSLC-TP-PC-CCI	Mr. Jim Washington	2800 Powder Mill Road Adelphi, MD 20783-1145	Av: 290/ (301) 394 /
LOGCEN ATCL-S	TBD	Ft. Lee, VA 23801-6000	Av: 687/ (804) 732 /
MICOM AMCPM-CC	TBD	Redstone Arsenal, AL 35898-5000	Av: 746/ (205) 876 /

UNCLASSIFIED

ANNEX 2

EXAMPLE MINUTES

Department of the Army

Armored Family of Vehicles Task Force

Fort Eustis, Virginia 23602-5597

DAMO-AFV DATE: __________

MEMORANDUM FOR RECORD MEETING NO: ______

SUBJECT: Minutes of Automation and Communication Resources Working Group (ACRWG) Meeting, Date, Item

1. PURPOSE:
   (Identify purpose of meeting)

2. ATTENDEES:
   See Encl 1 (Attach list of attendees as Encl 1)

3. DISCUSSION:
   (Identify issues and resolution)

4. ACTIONS TO BE TAKEN:

Date to be Accomplished	Action Required	Responsible Organization

5. Closing Remarks: (Summarize)

1 Encl
As stated
(others, as required)

Sitting
Chair, ACRWG

__________________ __________________

DIRECTOR, AFVTF — DEPUTY DIRECTOR, MATERIAL DEVELOPMENT

DATE: __________ DATE: __________

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AFV AUTOMATION & COMMUNICATIONS WORKING GROUP MEMBERS

Command, Office	Points(s) of Contact	Location	Av/ Comm/ Ext1/Ext2
OTEA CSTE-CA-E	TBD	5600 Columbia Pike Falls Church, VA 22041-5115	Av: 289/ (202) 756 /
Prg Ex Off AMCPEO-CCS	Mr. Dick Koval Mr. Joe Kernen	Hexagon Building Ft. Monmouth, NJ 07703-5000	Av: 995/ (201) 544 2677/
Prg Ex Off AMCPEO-COMM	TBD	Hexagon Building Ft. Monmouth, NJ 07703-5000	Av: 995/ (201) 544 /
SIGCEN ATZH-CDA	Maj Edgar S. Burroughs	Ft. Gordon, GA 30905-5090	Av: 780/ (404) 791 2800/3325
TACOM AMSTA-RVE	Mr. Curt Adams	Warren, MI 48397-5000	Av: 786/ (313) 574 8530/
TACOM AMSTA-ZEA	Mr. Carry Iller	Warren, MI 48397-5000	Av: 786/ (313) 574 9598/
TECOM AMSTE-TE-C	Mr. Edward A. Cheney	Aberd Prv Gd, MD 21005-5055	Av: 298/ (301) 278 4266/2477
TRADOC ATCD-ZD	Mr. Doug Pointer	Ft. Monroe, VA 23651-5000	Av: 680/ (904) 727 3466/
TRADOC ATCD-MH	Cpt Robert M. Kent, III Mr. William Jones	Ft. Monroe, VA 23651-5000	Av: 680/ (804) 727 4417/2776

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ANNEX C

AFV ACRWG MAILING LIST

Attached

Copies to: Attached

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AFV ACRWS INFORMATION AND SUPPORT MEMBERSHIP
(ACRWG Role: X=Member, S=Support, I=Information)

Command, Office	Title	Name	ACRWG Role	Autovon/Commercial	Telephone Ext1/Ext2
** Command: ADASCH Ft. Bliss, TX 79916-5000					
ATSA-CD*	Combat Developments	Cpt Fletcher Crp McElroy	S	Av:978/	6512/
** Command: ADEA Ft. Lewis, WA 98433-5000					
MODE-CCI-TS	CCI Integration Testing	LTC A. George Curtis Cpt Gordon Brooks	I	Av:357/(206) 967	5001/8598
** Command: AFVTF, DA Ft. Eustis, VA 23604-5597					
DAMO-AFV	Office of the Director	MG Robert J. Sunell	I	Av:927/(804) 878	1467/1468
DAMO-AFV-D	AFV Ind & Col Training Wrk Grp	MAJ Thomas Rozman (Training Working Groups)	I	Av:927/(804) 878	1463/1464
DAMO-AFV-D	AFV Combat Developments	Col Stephen Inman	I	Av:927/(804) 878	1465/1466
DAMO-AFV-D	AFV Manuever Working Group	LTC Anders Aadland	I	Av:927/(804) 878	1463/1464
DAMO-AFV-D	AFV Test Integration Wrk Group	Mr. Robert Nette (Test Integration Wrk Gp)	I	Av:927/(804) 878	1465/1466
DAMO-AFV-M	AFV ILS Mgmt Working Group	CPT Carlton M. Smith (ILS Working Groups)	I	Av:927/(804) 878	1463/1464
DAMO-AFV-M	AFV MANPRINT Working Group	MAJ Joseph Fil (MANPrint Working Groups)	I	Av:927/(804) 878	1463/1464
DAMO-AFV-M	AFV Materiel Developments	Col James Logan	I	Av:927/(804) 878	1465/1466
DAMO-AFV-M (DA)	AFV Auto & Comms Working Group	Maj Robert D. Buckstad (ACRWG, Project Officer)	X	Av:927/(804) 878	1465/1466
** Command: AMC, HQ Alexandria, VA 22333-[illegible]					
AMCDE-AO	AFV Action Office	Mr. Richard Ziegler	S	Av:284 [illegible] 274	[illegible]
AMCDE-AT	Computer Resource Development	Mr. James Fong Mr. Jack Evans	X	Av:284 [illegible] 274	[illegible]
AMCDE-E	Dev, Eng & Acq Sys Management	TBD	I	Av:284 [illegible] 274	
AMCPM-E	Office of TMDE Mangement	Mr. Richard B. [illegible]	I	Av:284 [illegible] 274	[illegible]
** Command: AMC, PM Ft. Monmouth, NJ [illegible]					
AMCPM-CC*	Army Information Systems	TBD	I	Av: [illegible]	
** Command: AMC, PM Orlando, FL 32813					
AMCPM-AVD	Aviation Training Devices	TBD	I	Av:791/	/
AMCPM-GFD	Ground Forces Training Dev	TBD	I	Av:791/	/
AMCPM-TND	Training Devices, TRADE	TBD	S	Av:791/	/
** Command: AMSAA Aberd Prv Gd, MD 21005					
AMXSY-D	Materiel Sys Analysis Activity	TBD	I	Av:298/(301) 278	/
AMXSY-L	Materiel Sys Analysis Activity	TBD	I	Av:298/(301) 278	/
** Command: ARDEC Dover, NJ 07806-5000					
SMCAR-CC		TBD	I	Av:880/(201)	
SMCAR-FS	Fire Control Systems	MAJ. James Herndon	I	Av:880/(201)	7151/
SMCAR-FSE-BV	VHSIC Development Office	Mr. Larry L. Yung	X	Av:880/(201)	7942/

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Command, Office, Title			ACRWG Role	Autovon/Commercial	Telephone Ext1/Ext2
++ Command: ARI	Alexandria, VA	22333-0001			
PERI	Army Research Institute	Mr. Ray Sidorsky	I	Av:284/(202) 274	9046/9105
++ Command: ARMSCH	Ft. Knox, KY	40121-5000			
ATSB-CD-ML		Cpt Dave Pride	X	Av:464/(502) 624	1750/5565
		Cpt Steve C. Pappas			
++ Command: ARMSCH,ARI	Ft. Knox, KY	40121-5000			
PERI-IK	Army Research Institute	Ms. Barbara A. Black	I	Av:464/(502) 624	2613/6928
++ Command: ARO	Research Tri Prk, NC	27709-2211			
SLCRO-DD/EL/MA	Army Research Office	Dr. Green	I	Av:935/(919) 549	0331/0641
++ Command: ATSC	Ft. Eustis, VA	23604-5597			
ATIC-DMD		TBD	I	Av:927/(804) 878	/
++ Command: AVIACEN	Ft. Rucker, AL	36362			
ATZQ-TSM-LHX	TSM-LHX	Maj. Jim Delashaw	I	Av:558/(205) 255	[illegible]
		NA			
++ Command: AVSCOM	St. Louis, MO	63120-1798			
AMSAV-NS		Mr. Charles J. Krill	I	Av:693/(314) 263	1074/1075
		Mr. Arthur W. Lindberg			
++ Command: BRDEC	Ft. Belvoir, VA	22060-5606			
STRBE-HC	Belvoir RD and Eng Center	Mr. Edward R. Eichelo	I	Av:354/(703) 664	[illegible]/5515
		Mr. John H. Holter			
++ Command: CAC	Ft. Leavenworth, KS 66027-5300				
ATZL-CAC	CCI Directorate	Col Larry [illegible]	I	Av:552/(913) 684	[illegible]
ATZL-CAC-A	CCI Dir, Integration Branch	Maj [illegible]	I	Av:552/(913) 684	[illegible]
ATZL-CAC-CC	CCI Dir.	Maj Mike Hawrylak	[illegible]	Av:552/(913) 684	[illegible]
ATZL-CAC-I	CCI Dir, IEW, ASAS	Maj Anne Rarsbacher	I	Av:552/(913) 684	3901/
ATZL-CAM-I	Mat Int,	Mr. Ben Stutler	I	Av:552/(913) 684	[illegible]
		Mr. Robert Buckingham			
ATZL-TAS		CPT DERR	I	Av:552/(913) 684	2495/3445
		Maj MAYES			
++ Command: CACDA	Ft. Leavenworth, KS 66027-5300				
ATZL-CAM	Materiel Integration Direct.	TBD	I	Av:552/(913) 684	/
++ Command: CATA	Ft. Leavenworth, KS 66027-5200				
ATZL-TAS		Cpt Sam B. Humes	I	Av:552/(913) 684	2495/3445
++ Command: CEAC	Washington, DC	20324			
CACC-FD		TBD	I	Av: /(202)	/

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AFV ACRWG INFORMATION AND SUPPORT MEMBERSHIP
(ACRWG Role: X=Member, S=Support, I=Information)

Command, Office, Title			ACRWG Role	Autovon/Commercial	Telephone Ext1/Ext2
** Command: CECOM Ft. Belvoir, VA 22060-5677					
AMCPM-NVD	Night Vision Devices	TBD	S	Av:354/(703) 664	/
AMSEL-RD-NV	Night Vision & Electro Optics	MAJ Sutton	S	Av:354/(703) 664	1424/
** Command: CECOM Ft. Leavenworth, KS 66027-5200					
AMCPM-OTDS-SDSC		TBD	S	Av:552/(913) 684	/
** Command: CECOM Ft. Monmouth, NJ 07703-5000					
AMCPM-MSCS	Multi-Service Comm. Syst.	TBD	S	Av: /(201)	/
AMCPM-MSE	Mobile Subscriber Equipment	TBD	S	Av: /(201)	/
AMCPM-MSE-ATC	Mobile Subscriber Equipment	TBD	S	Av: /(201)	/
AMCPM-PL	Pos Location Reporting Sys	TBD	S	Av: /(201)	/
AMCPM-SC	Satellite Communications,	TBD	I	Av: /(201)	/
AMCPM-TF	Field Arty Tactical Dta Sys	TBD	S	Av: /(201)	/
AMCPM-TMDE-M	TMDE Modernization	TBD	S	Av: /(201)	/
AMCPM-TMDE-S	Automatic Test Support Sys	TBD	S	Av: /(201)	/
AMCPM-TMDE-T	Test Program Sets	TBD	S	Av: /(201)	/
AMCPM-OTDS-PM	Operations Tact Data Sys	Mr. Frank Ninnen Mr. Arthur Moody	S	Av:992/(201) 532	2043/
AMCPM-TMDE	Test, Measurement & Diagnos	John Winter or H. WheelerSee AMCTM-E, Mr.Lindquist	S	Av:992/(201) 532	4200/1147
AMCPM-GARS	Single Chan Ground Air Radio	Lt. Beth Tallman	S	Av:995/(201) 544	3054/
** Command: CECOM Ft. Monmouth, NJ 07703-5001					
AMSEL-TDC	Technical Director	Mr. Campi	I	Av: (201)	
AMSEL-RD-ASCO	Advanced Sys & Concepts Office	Dr. Robert Christian Mr.Schoening,Mr.Mendric	X	Av:995 (201) 544	[illegible]
AMSEL-RD-CC	Center for CC Developments	C. Saganowich J. Slecra	I	Av:995 (201) 544	[illegible]
AMSEL-RD-LC	Center For Life Cycle Soft Eng	Mr. Mike Evans Mr. Karl Ister	I	Av:995 (201) 544	[illegible]
AMSEL-TPMO	Technical Programs Mgmt Office	Mr. Stephen Kurzer	I	Av:995 (201) 544	[illegible]
** Command: CECOM ASWC Warrenton, VA 22186-5100					
AMSEL-RD-SW	Signal Warfare Center	Mr. David Waldman	S	Av:249/	6202/
** Command: CHEMSCH Ft. McClellan, AL 36205-5030					
ATZN-CM-CC(C4)		Cpt Carl T. Simchick	I	Av:865/	3174/3653
** Command: CIS,LABCOM Fort Meade, MD 20755-5115					
AMSLC-CI	Combat Identification Sys	Col Billy White Richard Childress	S	Av:923 (301) 677	[illegible]
** Command: CIS,LABCOM Wrt-Pat AFB, OH 45433-5000					
ASD(AEI)	Joint IFF Sys Prog Office	TBD	S	Av:785 (513) 255	[illegible]

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Command, Office, Title			ACRWG Role	Autovon/Commercial	Telephone Ext1/Ext2
** Command: CSTA	Aberd Prv Gd, MD	21005-5059			
STEC-CO-PC	Combat Systems Test Activity	Mr. David C. Zupko Mr. Wesley Swank	I	Av:298/(301) 278	4522/3647
** Command: DA	Washington, DC	20310-0200			
DACS-DMA	DCS, AI Center of Excellence	Ltc Anccnatoni Maj Peterson	I	Av:224/(202)	6713/6907
** Command: DA	Washington, DC	20310-0653			
DALO-LEI	ODCSLOG	TBD	I	Av: /(202)	/
DAMO-FDC	ODCSOPS,	TBD	I	Av: /(202)	/
DAMO-FDY	ODCSOPS,	TBD	I	Av: /(202)	/
DAMO-FDZ	ODCSOPS, Combat Service Spt	TBD	I	Av: /(202)	/
DAMO-WSZ	ODCSOPS	TBD	I	Av: /(202)	/
DAMO-FDR	ODCSOPS, Reqts and Programs	LTC Lazicki	I	Av:223/(202)	2260/
SAIS-AD	DCSC4, Archit & Integration	COL Grippe LTC Travis	I	Av:224/(202) 694	6555/
SARD-TN	ASA-(RDA) Organization	Mr. Jim Stekert	I	Av:227/(202) 694	9432/
DAMO-FDD	ODCSOPS, Combat Maneuver	LTC Paul Ftasnik LTC Milne	I	Av:227/(202)	5443/
SARD-TR	ASA-(RDA) Organization	Mr. Bruce Zimmerman	I	Av:227/(202) 694	3558/
** Command: DMA	St. Louis, MO	63118-3399			
DMASC-[illegible]	Defense Mapping Agency	Mr. Robert Smith	I	Av:693/(314) 263	4260/
** Command: DMA	TBD	TBD			
DMAOD	Defense Mapping Agency	Maj Joseph Porter	I	Av:[illegible]94	[illegible]45[illegible]/
** Command: EMSSO-	Ft. Belvoir, VA	220[illegible]-5[illegible]			
[illegible]		MAJ Eric Fotte Mr. Jim Crowder	I	Av:354[illegible]	[illegible]
** Command: ETDL	Ft. Monmouth, NJ	07703-5302			
SLCET-I/R	Microelectronics Div	Maj Kevin Cogan Mr. Ed Hakin	I	Av:995/(201) 544	2253/2165
** Command: ETL	Ft. Belvoir, VA	22060-5546			
CEETL-TD-C		CPT William Foshay office: CEETL-TD-S, Alt	X	Av:345/(202) 355	2791/2792
CEETL-TD-S		Mr. Thomas M. Cox	I	Av:345/(202) 355	3023/
** Command: FASCH	Ft. Sill, OK	73503-5001			
ATSF-CD	Combat Developments	TBD	S	Av:639/	/
ATSF-DVS/OA		MR. DALEY MAJ HARDY	I	Av:639/	/

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Command, Office, Title			ACRWG Role	Autovon/Commercial	Telephone Ext1/Ext2
** Command: FATDS Scft Ft. Sill, OK		73503-5001			
AMCPM-FS		TBD	I	Av:639/	/
** Command: HEL	Aberd Prv Gd, MD	21005-5001			
SLCHE-CC	Close Combat Directorate	Cpt(P) Dick Koffrinke	X	Av:298/(301) 278	5946/
SLCHE-CC-LHD	Human Eng. Lab,C3 Modelling	Mr. Sy Steinberg	I	Av:298/(301) 278	5946/
SLCHE-CS	Combat Service Support Dir	TBD	I	Av:298/(301) 278	5970/
SLCHE-FS	Field Support Dir	TBD	I	Av:298/(301) 278	5504/
** Command: HEL,LABCOM Aberd Prv Gd, MD		21005-5001			
SLCHE (RTBG)	Robotics Tech Base Group	Mr. Charles Shoemaker	I	Av:298/(301) 278	5868/
** Command: HSC, AHS	Ft. Sam Houston, TX 78234-6100				
HSHA-CDM	Academy of Health Sciences	Maj Flint	I	Av:471/(512) 221	7151/5775
** Command: INFSCH	Ft. Benning, GA	31905-5400			
ATSH-CD-MLS-E		Mr. Arnold Smith	I	Av:835/(404 545	1910/
		Maj. Richard W. Whitney			
** Command: INTELSCH	Ft. Devens, MA	01433-6301			
ATSI-ETD		TBD	I	Av: /	
** Command: INTELSCH	Ft. Huachuca, AZ	85613-7000			
ATSI-CT		Mr. [illegible]	I	Av:879/(602) 533	
** Command: Joint TF	McLean, VA	22102			
JTFPI-[illegible]	Joint Tactical Fusion	Maj Jeff Sorenson	I	[illegible]	[illegible]
** Command: LABCOM	Adelphi, MD	20783-1145			
[illegible]	Plans & Prog, Tech Integration	LTC Hendrickson	I	[illegible] 394	
[illegible]	Plan & Prog, [illegible] Test	Mr. [illegible] Washington		[illegible] 394	
** Command: LABCOM,HEL Adelphi, MD		20783-1145			
SLCHD-ST (AITBG)	Art Intell Tech Base Group	Dr. Phillip Emmerman	I	Av:290/(202) 394	[illegible]
** Command: LOGCEN	Ft. Lee, VA	23801-6000			
ATCL-CD	CSSCS Development	Maj. Deny Strobel	I	Av:687/(804) 732	3819/3257
ATCL-M		TBD	I	Av:687/(804) 732	/
ATCL-S		TBD	I	Av:687/(804) 732	/
** Command: MICOM	Redstone Arsenal, AL35898-5000				
AMCPM-AD	Air Defense Systems	TBD	I	Av:746/(205) 876	/
AMCPM-CC	Air Defense Command & Control	TBD	I	Av:746/(205) 876	
AMCPM-CF	Chaparral/FAAR	TBD	I	Av:746/(205) 876	/
AMCPM-HA	HAWK	TBD	I	Av:746/(205) 876	/
AMCPM-HE	Hellfire/Ground Laser Desi	TBD	I	Av:746/(205) 876	/
AMCPM-MI	Modular Integrated Comm & Nav	TBD	I	Av:746/(205) 876	
AMCPM-ML	Multiple Rocket Launch	TBD	I	Av:746/(205) 876	/

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Command, Office, Title			ACRWG Role	Autovon/Commercial	Telephone Ext1/Ext2
AMCPM-PA	PATRIOT	TBD	I	Av:746/(205) 876	/
AMCPM-PE	PERSHING	TBD	I	Av:746/(205) 876	/
AMCPM-RP	Tactical Airborne RPV	TBD	I	Av:746/(205) 876	/
AMCPM-ST	STINGER	TBD	I	Av:746/(205) 876	/
AMCPM-TOW	TOW	TBD	I	Av:746/(205) 876	/
AMCPM-UV	Unmanned Aerial Vehicles	TBD	I	Av:746/(205) 876	/
** Command: MPSCH	Ft. McClellan, AL	36205-5030			
ATZN-MP-CCC	USAMPS-CSD-DCD	Cpt Joseph D. Richard	I	Av:865/	3510/
** Command: MRSA	Lexington, KY	40511-5101			
AMXDM-ED	Mat. Readiness Spt Activity	Mr. Phil Brooks Ms. Shelby Young	I	Av:745/(606) 293	4177/3170
** Command: Mis & Mun	Redstone Arsenal, AL35897-6500				
ATSK-TDN		CW4 Hunter	I	Av: /(205) 876	/
** Command: NGB	Washington, DC	20310-2500			
NGB-ARO-O	National Guard Bureau	Maj Veach	I	Av:227/(202)	2776/
** Command: NRDEC	Natick, MA	01760-5015			
STRNC-A	SICPS & AFV Developments	Ms. Joan Walker	I	Av:256/(617) 651	4624/
STRNC-AG	Natick RD&E Center	CPT David Armour Mr. John A. O'Keefe	I	Av:256/(617) 651	5542/5543
** Command: ORDBCH	Aberd Prv Gd, MD	21005-5201			
ATSL-CD	Combat Developments	TBD	I	Av:298/	
** Command: OTEA	Falls Church, VA	22041-5115			
CSTE-ZA-E		TBD	I	Av:289/(202) 756	
** Command: Prg Ex Off Dover, NJ		07801-5000			
AMPEO-CCA	Close Combat Armaments	TBD	I	Av:880/(201)	
** Command: Prg Ex Off Edgewood Arsenal, MD					
AMPEO-NBC	Chemical and Nuclear Systems	TBD	I	Av: /	/
** Command: Prg Ex Off Ft. Belvoir, VA		22060-5606			
AMPEO-STAMMIS	Std Ar Mult Cmd Info Mgmt Sys	TBD	I	Av:354/	/
** Command: Prg Ex Off Ft. Monmouth, NJ		07703-5000			
AMCPEO-CCS	Command & Control Systems	Mr. Dick Koval Mr. Joe Kernen	X	Av:995/(201) 544	2677/
AMCPEO-COMM	Communication Systems	TBD	X	Av:995/(201) 544	/
** Command: Prg Ex Off Huntsville, AL					
AMPEO-CCM	Close Combat Missiles	TBD	I	Av: /	/
AMPEO-FAAD	Forward Area Air Defense	TBD	I	Av: /	/

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Command, Office, Title			ACRWG Role	Autovon/Commercial	Telephone Ext1/Ext2
AMPEO-FS	Fire Support Systems	TBD	I	Av: /	/
** Command: Prg Ex Off St. Louis, MO 63120					
AMPEO-TS	Troop Support	TBD	I	Av: /	/
** Command: Prg Ex Off Warren, MI 48397-5000					
AMPEO-CCV	Close Combat Vehicles	TBD	I	Av:786/(313) 574	/
AMPEO-CS	Combat Support	TBD	I	Av:786/(313) 574	/
** Command: Prg Ex Off Warrenton, VA 22186-5100					
AMCPEO-IEW	Intell/Electr Warfare Systems	Mr. Rob Ruth	S	Av:249/	/
** Command: Prg Ex Off Washington, DC 20332					
AMPEO-AMMO	Ammunition Systems	TBD	I	Av: /(202)	/
AMPEO-ENG	Engineer Systems	TBD	I	Av: /(202)	/
AMPEO-HCS	Health Care Systems	TBD	I	Av: /(202)	/
** Command: CMSCH Ft. Lee, VA 23801-5037					
ATSM-CD		TBD	I	Av:687/(804)	/
** Command: SIGCEN Ft. Gordon, GA 30905-5090					
ATZH-CDC	Combat Developments, DCD	CPT Rick Simcnik	I	Av:780/(404) 791	6663/
** Command: SIGCEN Ft. Gordon, GA 30905-5090					
ATZ-[illegible]	[illegible], Combined Arms Branch	Maj Edgar S. Burroughs	X	Av:780/(404) 791	[illegible]
ATZ-[illegible]	[illegible]	Mr. Woodrow Miller, Jr. ACRWG Alt	I	Av:780/(404) 791	[illegible]
ATZ-[illegible]		TBD	I	Av:780/(404) 791	
** Command: SSC Ft. Ben Harrison, IN [illegible]					
[illegible]	Soldier Support Center	TBD	I	Av:	
[illegible]	Chair, [illegible]	CPT [illegible] Harwood, [illegible]	I	[illegible]	[illegible]
** Command: [illegible] Dover, NJ 07801-5000					
AMCPM-TMA	Tank Main Armament System	TBD	I	Av:880/(201)	/
** Command: TACOM Warren, MI 48397-5000					
AMCPM-BFVS	Bradley Fighting Vehicle S	TBD	I	Av:786/(313) 574	/
AMCPM-SCG	Tank Systems (Combat Vehicles)	TBD	I	Av:786/(313) 574	/
AMCPM-HTV	Heavy Tactical Vehicles	TBD	I	Av:786/(313) 574	
AMCPM-LAV	Light Armored Vehicles	TBD	I	Av:786/(313) 574	
AMCPM-LCV	Light Combat Vehicles	TBD	I	Av:786/(313) 574	
AMCPM-M1	M1 Abrams Tank System,	TBD	I	Av:786/(313) 574	
AMCPM-M113	M113 Family of Vehicles	TBD	I	Av:786/(313) 574	/
AMCPM-M1A1	M1A1 Abrams Tank	TBD	I	Av:786/(313) 574	
AMCPM-M60	M60 Tanks	TBD	I	Av:786/(313) 574	/
AMCPM-M9	M9/Armored Combat Earthmov	TBD	I	Av:786/(313) 574	
AMCPM-MTV	Medium Tactical Vehicles	TBD	I	Av:786/(313) 574	/

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(ACRWG Role: X=Member, S=Support, I=Information)

Command, Office, Title			ACRWG Role	Autovon/Commercial	Telephone Ext1/Ext2
AMCPM-TV	Tactical Vehicles	TBD	I	Av:786/(313) 574	/
AMCPM-TVH	Commercial Construction Eq	TBD	I	Av:786/(313) 574	/
AMCPM-TVL	Light Tactical Vehicles	TBD	I	Av:786/(313) 574	/
AMSTA-RR	Robotics Division, Tech Dir.	MAJ Leonard Ogborn	I	Av:786/(313) 574	/
AMSTA-RVE	Vetronics Division, Tech Dir.	Mr. Curt Adams	X	Av:786/(313) 574	8530/
AMSTA-RVE(SAVA)	Std Army Vetronics Arch Commit	Mr. Don Sarna	I	Av:786/(313) 574	6160/
AMSTA-ZEA	Advanced Sys & Concepts Off	Mr. Carry Iller	X	Av:786/(313) 574	8598/
** Command: TECOM	Aberd Prv Gd, MD 21005-5055				
AMSTE-TE-C		Mr. Edward A. Cheney	X	Av:298/(301) 278	4056/2477
** Command: TRAC-FLVN	Ft. Leavenworth, KS 66027-5200				
ATOR-	TRADOC Analysis	Cpt Randy Brown	I	Av:552/(913) 684	5511/
ATRC-FS		TBD	I	Av:552/(913) 684	/
** Command: TRAC-WSMR	Whte Sds Mis Rng, NM88002-5502				
ATRC-WAA		Maj David Davis	I	Av:258/(505) 678	4046/1373
ATRC-WSMR		TBD	I	Av:258/(505) 678	/
** Command: TRADOC	Ft. Monroe, VA 23651-5000				
ATCD-CC	C4 Directorate	Mr. Doug Pointer	X	Av:680/(804) 727	3466/
ATCD-CS		Cpt Samoie	I	Av:680/(804) 727	/
ATCD-FX	ADA & FS Automated Systems	Mr. Ebner, FAADCCI Ltc Filak, AFATDS	I	Av:680/(804) 727	2171/2175
ATCD-I	Intel & EW, ASAS CD	Mr. Hilderman Mr. Waller	I	Av:680/(804) 727	
ATCD-[illegible]	Close Combat Heavy Dir, Br CDI	Cpt Robert [illegible], III Mr. William Jones	I	Av:680/(804) 727	[illegible]
** Command: TROSCOM	Ft. Belvoir, VA 22060-5606				
AMCPM-TSS	Topographic Support System	TBD	I	Av:354	
** Command: TROSCOM	Springfield, VA 22150				
AMCPM-MEP	Mobile Electric Power	TBD	I	Av: /	
** Command: USAISEC	Ft. Belvoir, VA 22060-5456				
ATTN:	Info Sys Eng Command	TBD	I	Av: /	/
TACMIS	Tactical Mgmt Info Systems	Col McFadden Maj Mac Hopkins	I	Av:370/(404) 545	6900/7961

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ANNEX 4

PROCEDURES

The ACRWG will meet periodically at a time and place determined by the chair in coordination with the members. At least three weeks prior to each meeting, the chairman will provide the member agencies with the time, place, and agenda of items for the upcoming meeting. This will allow ACRWG members to effect necessary internal coordination and prepare scripts and briefing material. Representatives will come prepared with scripts, briefing slides, and supporting documents for discussion of action items past, current, and future. Presentations by the membership will be included in the minutes of the meeting, as appropriate.

When an agenda item is not completed or is unresolved at the end of a ACRWG meeting, it will be assigned to a member for action, with an appropriate suspense date. Open action items become part of the ACRWG Action Item List and are carried over to the next ACRWG agenda either to verify that action has been completed or to accomplish the necessary pending action. In the event of a disagreement among the members, unresolvable by the chair, the issues will be presented for resolution through normal command or staff channels. Non concurring members are responsible to escalate the issue with in their command and cause intercommand next-level-coordination in order to resolve

C.12

disagreements. Minutes of each meeting are prepared by the ACRWG recording secretary for signature by the chair and distributed to each member. The minutes document all decisions, agreements, and actions of the ACRWG and become a part of the official file on the system. Inaccuracies in the minutes should be brought to the attention of the chair for correction of for addition to the Action Item List for resolution. Record secretary duties may be rotated among the members. Minutes of a ACRWG meeting will be mailed to each member within ten working days of the meeting. Review and formal concurrence will be returned to the ACRWG secretary within 30 days of the ACRWG meeting. The recommended format for minutes is in Annex 2. Emphasis to the following areas will assure clear, concise, unambiguous ACRWG minutes:

a. Provide recommendations for resolving the problem and the impact as a result of the proposed recommendations, when a problem is cited or implied.

b. Provide an impact statement as to the effect of the problem(s) on the total program, i.e., slippages, spare parts, manuals, missing contract award dates, missing IOC dates, etc.

c. Task the appropriate ACRWG members, and others, and provide an agreed upon milestone program to resolve problems which exist.

d. Specify follow-up actions from prior meetings and the status of those actions.

APPENDIX D

Armored Family of Vehicles (AFV)

Task Force (TF)

Technology Points of Contact (POC)

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AFV CRMP
VOLUME XV

1 SEPTEMBER 87
TECHNOLOGY POINTS OF CONTACT

TECHNOLOGY AREA	AFVTF POC	TELEPHONE
		(A) 927-XXXX (B) (804) - 878-XXXX
ARMOR	MAJ WINTER	1463/1464
MOBILITY	LTC AADLAND	1463/1464
PROPULSION	LTC AADLAND	1463/1464
SENSORS	LTC HALLISSEY	1465/1466
FIRE CONTROL	MAJ(P) ROZMAN	1463/1464
LETHALITY	MAJ(P) ROZMAN	1463/1464
SIGNATURE SUPPRESSION	MAJ FIL	1463/1464
NBC PROTECTION	MAJ FIL	1463/1464
HUMAN FACTORS	MAJ FIL	1463/1464
PRODUCIBILITY	CPT SMITH	1463/1464
DIAGNOSTICS	CPT SMITH	1463/1464
PROGNOSTICS	CPT SMITH	1463/1464
ROBOTIC AUTOLOADER	MAJ(P) ROZMAN	1463/1464
ROBOTIC REFUEL MANIPULATOR	CPT SMITH	1463/1464
ROBOTIC REARM MANIPULATOR	CPT SMITH	1463/1464
ROBOTICS - AFV	MAJ BUCKSTAD	1465/1466
ROBOTICS-MINE WARFARE	LTC AADLAND	1463/1464
COUNTER MEASURES	MAJ KING	1465/1466
COUNTER COUNTER MEASURES	MAJ KING	1465/1466

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TECHNOLOGY AREA	AFVTF POC	TELEPHONE
		(A) 927-XXXX (B) (804) - 878-XXXX
COMMAND AND CONTROL	MAJ BUCKSTAD	1465/1466
COMMUNICATIONS	MAJ BUCKSTAD	1465/1466
COMPUTERS	MAJ BUCKSTAD	1465/1466
VETRONICS	MAJ BUCKSTAD	1465/1466
THREAT	LTC GIBSON	1463/1464
FOREIGN TECHNOLOGIES	LTC GIBSON	1463/1464
DIRECTED ENERGY WEAPON	MAJ GREGG	1465/1466
OTHER		
ARTIFICIAL INTELLIGENCE	MAJ BUCKSTAD	1465/1466
TECHNOLOGY ASSESSMENT	MAJ KING	1465/1466

ALTERNATE TELEPHONES: (A) 927-1467/68 OR (804) 927-1467/68

DATAFAX SEND: (A) 927-[illegible]
DATAFAX CONFIRM: (A) 927-4748/5409
DEFENSE DATA NETWORK (DDN):

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APPENDIX E

Armored Family of Vehicles

Requirement and

Planning and Requirements Documents

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DOCUMENT		AFVTF POC
Volume I	Executive Summary	Col Logan/Col Inman
Volume II	Armored Family of Vehicles Main Study Report	
Volume III	ASARC Documentation	
Chapter 1	Concept Formulation Plan	
Chapter 2	System Concept	
Chapter 3	Baseline Cost Estimate	
Chapter 4	Test Evaluation Master Plan	Mr. Nette
Chapter 5	Integrated Logistics Support Plan	Cpt Smith
Chapter 6	RSI Plan	Ltc Gibson
Chapter 7	Threat Support Plan	Ltc Gibson
Chapter 8	SMMP	Maj Fil
Volume IV	Concept Formulation Package (CFP)	
Chapter 1	Cover Letter	
Chapter 2	TOD	Ltc Aasland
Chapter 3	TOA	Ltc Aasland
Chapter 4	ETA	Ltc Aasland
Chapter 5	COEA Summary	Ltc Hallissey
Volume V	Systems Concept Paper (SCP)	Maj Winter
Volume VI	Training Strategy	Maj Rozman

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Volume VII	AFV Capstone Required Operational Capability (ROC)	Ltc Aadland
Appendix I	Rationale	
Appendix II	COEA	
Appendix III	RAM Rational	
Appendix IV	Training Devices	
Annex A.	Life Cycle Cost Assessment	
Annex B.	O&O Plan (approved)	
Annex C.	Coordination	
Volume VIII	Initial Cost Operational Effectiveness Analysis (COEA)	Ltc Halissey
Volume IX	Technology Assessment	Maj King
Volume X	Cost Programming	Ltc Bryant
Volume XI	Trade-offs	Ltc Aadland
Volume XII	Supporting Documentation for the AFV Plan	
Chapter 1	Charter for DA AFV-TF	
Chapter 2	O&O Plan	
Chapter 3	IMBNS AFV	
Volume XIII	Literature Search	
Volume XIV	Computer Resources Management Plan (CRMP)	Maj Buckstad

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Volume XV Light Forces Maj DuVall

Volume XVI Force Deficiencies

Volume XVII Combat Effectiveness

(Telephone AV 927-1457/58 or (904) 927-xxxx)

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APPENDIX F

Management Milestone Checklist(s)

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ITEM	RESPONSIBILITY
1. Mission Area Analysis	DCSOPS MD CD
2. O&O Plan	CD MD
3. JMSNS	
4. Program Initiation and level of management determination	CD DCSOPS
5. Task Force Formation	
6. Mission Critical Computer Resource Planning	AMC MD
a. Computer Resource Working Group (CRWG)	
b. Preliminary Computer Resource Life Cycle Management Plan	
7. Development of Alternatives	CD MD
a. NDI	
b. PII	
c. PI	
8. Evaluation of Alternatives	CD MD
9. Preparation of Concept Forumulation Package (CFP)	CD MD
TOD, Tradeoff Determination	
TOA, Tradeoff Analysis	
BTA, Best Technical Approach	
COEA, Cost Operational Effectiveness Analysis	

ITEM	RESPONSIBILITY
10. Total Life Cycle Competition Strategy (TLCCS) and Manprint Planning	CD
11. Preparation of Acquisition Strategy (AS)	MD
Producability Engineering Planning	
Test and Evaluation	
Design to Cost	
Technical Risks	
Manprint	
Computer Resources	
12. Preparation of Acquisition Plan (AP) (ILSP, TEMP, CRMP summarized)	MD
13. Preparation of initial input to the program management control system (PMCS)	DCSOPS MD CD
Materiel System Requirements Specification	
Ref: AR 70-1	
14. Preparation of Cost Estimates Baseline Cost Estimate (BCE)	MD Comptroller of the Army (COA)
15. Preparation of System Concept Paper (SCP)	CD MD
16. Integrated Log. Support Plan (ILSP)	MD in coordination with CD log, trainer
17. TEMP	
17A. CRMP	MD LCSSF
AR70-1, DOD STD 2167	

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ITEM	RESPONSIBILITY
18. Omitted, future use.	
19. JRMB (Joint Reqmt Mgmt Board)	AAE DCSOPS
20. Update Program Mgmt Documents (PMD) prior to DT/OTIC AR 71-9	MD in coordination with CD
21. Input to DT/OT I and preporation of Development Test Plan Plan and operation Test Plan I	Operational tester
22. Award of Advanced Development Prototype Contract	MD
23. Development Test I (DT I) MD	
24. Operational Test I (OT I)	Operational tester
25. Prepare DT I and OT I test reports.	MD Operational tester
26. Update Program Management Documents. a. ILSP b. IITP c. DTC Plan d. AS e. IEMP f. TEMP g. IIEA h. ROC	
27. Prepare Qualitative and Quantitative Personnel Requirement Information and Basis of Issue (BOIP)	MD CD
28. Tentative Military Occupation Specialty (TMOS) evaluation input-manprint	HQDA DCSPER

	ITEM	RESPONSIBILITY
29.	New Equipment Training Plan (NETP)	Trainer MD
30.	Prepare and Approval of Required Operational Capability (ROC) or Training Device Requirement	
31.	Review and Approval of ROC or TDR with BOIP and QQPRI	CD DCSOPS
32.	Preparation of Cost Estimates	
33.	Decision Coordination Paper (DCP) and Integrated Program Summary	MD CD AAE
34.	Staff and Revise the DCP (and IPS if required).	AAE MD
35.	DT I and OT I independent evaluation Reports (IER)	MD Operational Tester
36-37.	IPR AAE JRMB (Milestone I/II) Approval	OSD/HQDA
38.	Producability Engineering and Planning (PEP); Manufacturing Methods and Technology (MMT); Identification of Long Lead Components (LLC); and Industrial preparedness Planning (IPP)	MD
39.	Input to DT/OT II and prepare DT/OT II Test design plans Ref: AR 70-10, 71-3, 10-4	
40.	Award of contract of engineering development (ED)	MD
41.	Conduct of Operational Test II (OT II)	Operational Tester

ITEM	RESPONSIBILITY
42. Conduct Development Test II (DT II)	MD
43. Preparation of DT/OT II test reports	MD Operational Tester
44. Conduct New Equipment Training (NET)	MD
45. Logistic Support Planning and Technical Manuals (TM)	MD CD
46. Training Planning and draft field Manual (FM)	Trainer in coordination with MD, LCSSF CD
47. Revision of QQPRI and MOS Requirements	MD HQDA
48. Draft Plan Table of Organizaiton (TOE) and update BOIP	CD
49. Preparation of Cost Estimates	
50. Update program Management Documents, CRMP, DCP	
51. DT II and OT II independant evaluation reports	MD, Operational Tester
52. Development acceptance (DEVA) IPR, DEVA IPR approval and type classification as standard or limited procurement	
53. ASARC and JRMB (Milestone III) approval	
54. Contract award for low-rate initial production	MD
55. Initial production facilities	
56. Input to DT/OT III and preparation of DT/OT III test design plans	

ITEM	RESPONSIBILITY
57. OT III	Operational Tester
58. DT III	MD
59. Preparation of DT/OT III reports.	
60. Update, revise and staff DCP and PMD Documents	
61. Final QQPRI and MOS decisions	
62. Revision and approval of Basis of Issue Plan (BOIP)	CD DCSOPS
63. DT III and OT III independant evaluation reports.	
64. Preparation of Cost Estimates	MD Comptroller of Army (COA)
65. Production Validation (PV) IPR and Approval	
66. Type Classify Standard	
67. ASARC and JRMB (Milestone III) approval of full production	
68. Review of existing field manuals (FM) (Doctrinal), first edition of final draft of FM	Trainer
69. Review and publication of technical manuals	MD
70. Review, approval and publication of TOE	
71. Contract Award/Full Production	MD
72. Production Qualification Test (PQT)	MD
73. First Article Test (FAT) and Follow-on and Evaluation (FOTE)	Operational Tester

ITEM	RESPONSIBILITY
74. First Unit Equipped (FUE)	
75. Production Acceptance Test and Evaluation Value Engineering (VE) and composition of the Technical Data Package (TDP)	MD
76. Documentation in the Army Authorization Documents System (TAADS) or Common Table of Allowance (MTOES)	
77. Resident Training	Trainer
78. Initial Operational Capability (IOC)	MD
79. Begin Unit Training	
80. Development of final maintenance man-hours (AMMH) data	MD
81. Development, approval and publication of TOE manpower requirements criteria (MARC)	CD
82. Materiel Objective Attained	MD
83. Overhaul/Retrofect	MD
84. Revised Training program and field manuals	Trainer
85. Revised Technical Manuals	MD
86. Revised TOE	CD
87. Published revised TOE/FM/TM	
88. Product Improvement	MD
89. Requirement for new replacement materiel identified and type classify contingency	CD/MD
90. Type classify obsolete and disposal	MD

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Checklist to Prepare for Milestone I/II Review

1. Have feasibility studies been accomplished to determine that the use of computer resources in the system is reasonable and justified?

2. Has supportability of the system been taken into account?

3. Has the overall software quality evaluation process for the software development cycle been defined to the maximum extent practicable?

4. Has an acquisition strategy been formulated and documented?

5. Has the TEMP been developed to document planned tests and continuous evaluation?

6. Have the following areas been addressed?
   a. Evaluating approved operational concepts?
   b. RSI (rationalization, standardization, and interoperability)?
   c. Organization?
   d. MANPRINT (manpower and personnel integration)?
   e. Personnel (mental category mix, male-female mix, physical requirements, and special skills)?
   f. Human Factors Engineering (HFE)?
   g. System safety and health hazards?
   h. HARDMAN (hardware versus manpower) methodology?
   i. NDI and PIP considerations?
   j. Developing system testability and fault diagnosis or isolation concepts?
   k. Considering the use of modular construction and standard parts and components in the design concept?
   l. Identifying major items of support-related hardware and software requiring development and their interoperability requirements?
   m. Establishing system readiness objectives?
   n. Considering combat sustainability through battlefield dammage assessment and repair?
   o. Establishing the strategy and goals for system surge and mobilization capacity?
   p. Establishing strategy for minimizing system vulnerability?

7. Have risk areas been identified?

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8. Has a preliminary CRMP been prepared, submitted, and approved by the appropriate approval authority prior to holding Milestone I/II review?

9. Has the System Requirements Review been accomplished?

10. Has an automation and communications resources working group (ACRWG) been established?

11. Has the LCSEC or LCSECs been identified?

12. Have all non-developmental item (NDI) development tools and application software packages been identified?

13. Has all government furnished software been identified?

14. Will all software development and hardware support tools be delivered to the LCSEC as part of the contract?

15. Which Ada Program Design Language (PDL) is the contractor going to use?

16. Will the LCSEC maintain configuration management of the software?

17. Are proper programming standards being used for development?

18. Are the standards adequate enough to ensure that the documentation will be adequate for life cycle maintenance?

19. Is security protection required for the software and hardware in the development/maintenance environment?

20. Have the resources necessary to support the LCSEC been planned for?

21. Has planning been completed for the acquisition of computer resources needed to achieve the required operational capability?

22. Is the plan for system testing adequate?

23. Has enough data been gathered to accurately formulate budgetary estimates and program schedules for computer resources?

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24. Have sizing and timing studies been conducted to determine minimum spare processing time, memory, and input/output channel activity?

25. Is the computer hardware a standard ISA to the maximum extent practicable?

26. Has a program language been selected and approved?

27. Have software support issues been discussed (i.e. Government-provided software support versus contractor support)?

28. Has an Interface Control Board (ICB) been established to address system/subsystem interface requirements?

29. If prototype software is to be used in the Full Scale Development or Production and Deployment phases, has it been developed in accordance with the computer software development cycle (or tailored protion thereof)?

30. Has the System Design Review been completed?

31. Has the overall approach for configuration management (CM) of computer resources been defined?

32. Has the software quality evaluation process for the software development cycle been refined?

33. Has the testing concept as specified in the TEMP been refined?

34. Does the TEMP adequately identify quantitative and demonstrable test objectives (performance, functional, interface, etc.)?

35. Has an appropriate evaluation criteria been established for testing whether software and hardware have reached a level of maturity appropriate for each system life cycle phase and for proceeding into the next phase?

36. Has the level of need for independent verification and validation been accessed?

37. Has the CRMP been updated?

38. Have all outstanding CRMP issues been identified with a plan for their resolution?

39. Has the system/segement specification been updated and finalized to incorporate any comments received during the SRR?

40. Has a draft software requirements specification been completed taht documents requirements for each CSCI?

41. Have logistics, interoperability, and computer resource problems identified during the Concept Exploration Phase been resolved or minimized?

42. Have formal requirements documents been prepared (i.e. required operational capability (ROC), training device requirements (TDR))?

43. Has personnel equipment and basic force design been determined?

44. Have security issues been assessed?

45. Have cost estimates been updated?

46. Has the acquisition plan been finalized?

47. Have contractual requirements been developed that clearly define the following:
    a. Baseline operational servicing and support?
    b. Peacetime readiness and wartime employment objectives?
    c. Time phased support schedule objectives?

48. Has a functional failure mode effects and criticality analysis (FMECA) been performed?

49. Have critical thresholds been allocated to the system and subsystem compatible with RAM, safety and health objectives?

50. Have areas requiring intensive application of R&D resources to minimize risk been identified?

51. Has a maintenance concept been developed?

52. Have all failure modes been fully documented, with specific corrective actions identified and risk assessments performed?

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Checklist to Prepare for the System Requirements Review

1. Have trade-off and optimization studies been performed to evaluate alternative approaches and methods to reach system goals? Is the candidate programming language Ada?

2. If the candidate programming language is not Ada, has a waiver been granted?

3. Are the candidate computer architectures for the system one of the standard Instruction Set Architectures (ISA's)?

4. Have allocations of security requirements to particular HWCIs and CSCIs been analyzed?

5. Have the risk areas and factors of the project been identified?

6. Have systems interfaces, communication functions, personnel functions been identified in order to define the requirements for computer resources?

7. Have all essential system functional characteristics been identified?

8. Have the necessary interface characteristics been identified?

9. Hve the functional characteristics of hardware and software configuration items been defined?

10. Have design constraints been identified and documented?

Checklist to Prepare for the System Design Review

1. Have system requirements been completed and defined for each HWCI and CSCI?

2. Have appropriate trade-off and optimization studies been performed to evaluate:
   a. Alternative approaches and methods for meeting system requirements?
   b. The effects of constraints on the computer resources?
   c. Life cycle costs versus operational requirements?
   d. Risks in computer resources due to untried technology?

3. Have all applicable Type B - Development specifications been prepared?

4. Have the functional, interface, quality factor, special, and qualification requirements necessary to design, develop, test, evaluate, and deliver each Computer Software Configuration Item (CSCI) been adequately described?

5. Have all interface requirements between CSCIs been described in detail?

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APPENDIX G

ARMORED FAMILY OF VEHICLES (AFV)
INTEGRATED
COMMAND, CONTROL, AND
COMMUNICATIONS (C3)

(TO BE PUBLISHED)

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APPENDIX H

ACTIVITIES FOR
LIFE CYCLE SOFTWARE ENGINEERING
CENTER (LCSEC) SUPPORT

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A. Document Mission Critical Computer Resources (MCCRs) - Initiate MCCR Survey(s) that will document all Points of Contract (POC's), hardware and software information, and related diagrams and descriptions throughout the life cycle of AFV.

B. Identify Personnel/Technical Skills Needed - Through the use of the AFV survey(s) and other sources, identify the software personnel needed to support AFV.

C. Create a Library - The LCSEC librarian will begin preparation needed for housing any incoming documentation during the AFV life cycle.

D. Acquire Partial Software Personnel Crew - Activities at this stage of software support will require minimal personnel.

E. Identify Hardware and Software System Components - Using the AFV MCCR Survey(s) and other relevant information, establish a listing of all AFV hardware and software system components.

F. Identify System Support Hardware and Software - Through examination of the AFV MCCR Survey(s) and the identified system components, establish a list of all support hardware and software required.

G. Acquire Remaining Personnel - Gather all remaining software personnel.

H. Acquire Documentation/Technical Publications - Acquire all technical manuals, publications, specifications, and other information related to AFV for eventual filing in the LCSEC library. This will be an ongoing effort throughout the life cycle of the program.

I. Prepare Software Support Plan - A software support plan will be prepared to familiarize any new, minimally trained personnel with AFV. These personnel will be able to effect software support procedures in the same manner that the original system engineer envisioned support taking place.

J. Familiarize Personnel with System Software Configuration - The AFV project engineer will provide all pertinent information to software personnel so they can become knowledgeable of the AFV software structure.

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K. <u>Prepare LCSEC Procedures</u> - LCSEC procedures can be developed once the personnel have a knowledgeable understanding of the AFV software. An outline for preparing the LCSEC procedures can be found in the concept of operations guidebook, available from the project engineer.

L. <u>Define Space and Security Requirements</u> - Define space and security requirements with respect to on-hand resources.

M. <u>Prepare Test Cell</u> - After space and security requirements have been defined, an area will be designated and prepared (including power requirements and storage) to serve as a test cell.

N. <u>Acquire System and Support Items</u> - Acquisition of the System and its associated support hardware will begin after the defining of space and security requirements for the test cell. The support software will be acquired, developed, or copied if available.

O. <u>System Installation</u> - All AFV system components and support items will now be installed in the prepared test cell.

P. <u>Develop and Conduct Integration Procedures</u> - Test procedures will be developed and conducted to insure that the cell is operational and simulates inputs as required. Test results will be revised and documented as required.

Q. <u>Develop Configuration Management (CM) Plan Annex</u> - The CM plan annex will define management practices with respect to revision/configuration updates, supervision of modifications, and inservice status accounting.

R. <u>Conduct System Hardware Training of Personnel</u> - Once the system is installed in the test cell, the personnel can begin hands-on training with the equipment.

S. <u>Conduct Software Tests/Emulation</u> - A thorough testing and emulating of the complete system will be conducted at the stage. This is the last step before the system is geared for LCSEC procedures. An evaluation of the system and its software will be performed by using a software support program that emulates operation of the actual airborne system. Operation tests are performed by inputting sample data with known results. If the results do not match the

AD-A190 934 ARMORED FAMILY OF VEHICLES (AFV) AUTOMATION AND 4/4
COMMUNICATION RESOURCE MA..(U) ARMORED FAMILY OF
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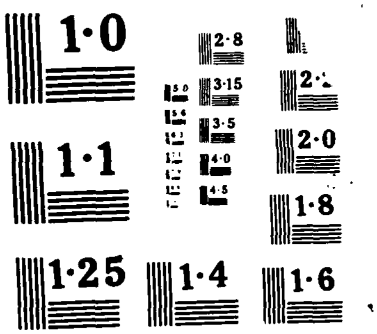
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1·4
1·6

pre-determined results, a problem exists. Testing and emulation will continue until all combinations of the system software have been verified.

T. Center Operations -

A. Management
B. Clerical Assistance
C. Budgeting
D. Telephone Commercial Direct Access
E. Paper Reproduction High Vol
F. Local Network

U. Develop Continuity Of Operations Plans

V. Administration Preparation - Prior to staffing administrative requirements preparation must occur. Technical staff should not be overloaded with ordering manuals, equipment, etc. that are required for day to day operations.

H.4

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APPENDIX I

Software Development Reviews

I.1

A. Informal Technical Reviews

- System requirements Review (SRR) - Here the government and the contractor ensure that system requirements have been completely and properly identified and that there is mutual understanding between them on the system requirements.

- System Design Review (SDR) - A review of the conceptual design of the system to assess allocation requirements and to evaluate the contractors overall development capability. A preliminary Software Requirements Specification (SRS) shall be available for this review.

- Software Specification Review (SSR) - This is a review of the finalized Computer Software Configuration Item (CSCI) requirements and operational concept. The adequacy of the SRS will be determined at this review.

- Preliminary Design Review (PDR) - This review shall be held after preliminary design efforts, but before start of detailed design. The Software Top Level Design Document (STLDD), Software Test Plan (STP) and preliminary Computer Resources Integrated Support Software Document (CRISD) shall be available at this review.

B. Critical Design Review (CDR) - The draft Product Specifications, will be reviewed and the contractor's product baseline established. The contractor will present the results of their detail design effort which demonstrates:

- The allocation of requirements to individual modules, to include a complete module input and output mapping;

- The establishment of exact interface relationships between the modules and other programs or items of equipment and facilities; and,

- The organization of the file structure or data base in support of the design. The CDR marks the completion detailed design and the beginning of coding.

C. Formal Qualification Review (FQR) - This review verifies that configuration items comprising the system meet contractual performance requirements. If feasible, the FQR will be combined with the Functional Configuration Audit (FCA).

D. Functional Configuration Audit (FCA) - The FCA shall validate that configuration items have achieved the performance and functional characteristics specified in the functional or allocated configuration identification.

E. Physical Configuration Audit (PCA) - The PCA will establish the completeness of the computer program data package and confirm that all physical items required by the contract have been produced. Upon successful conclusion of the FQR, FCA AND PCA, the approved Product Specifications will establish the product baseline.

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APPENDIX J

CRMP Development Milestones

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MILESTONE	EXPECTED COMPLETION
1. Computer Scientist assigned to Task Force to assist in computer resource development.	
2. Communication specialist assigned to Task Force to assist in communication development	
3. Preliminary CRMP has been prepared for automation and communication resource management.	
4. Qualified communication and computer resource personnel included in the Test Integration Working Group (TIWG)	
5. AMC, TRADOC review of CRMP	
6. Designation of a Life Cycle Software Support (LCSS) Center for support of the AFV project.	
7. A computer resource working group has been established.	
8. Qualified Army CR personnel have been included in source selection team(s) to assist the Director to evaluate technical proposals.	
9. The System Specification, Statement of Work, and associated DD Form 1423 (data items) have been reviewed by qualified Army CR personnel and that they have certified that adequate/appropriate CR requirements have been incorporated.	
10. Proper data right clause has been incorporated into the RFP(s)/contract(s)	
11. Final draft CRMP prepared in support of DARCOM-R-70-16	
12. HQ DA aproval of CRMP.	

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13. Milestone I/II.

14. Submission of waiver requests for intention to use a programming language ither than Ada.

15. HQ DA approval of waiver requests for use of software other than Ada

16. Government formal certification of AFV computer software IAW DARCOM-R 700-34.

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APPENDIX K-Y

RESERVED FOR FUTURE USE

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APPENDIX Z

REFERENCES

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Military Standards

DOD-STD 480A	Configuration Control-Engineering Changes, Deviations and Waivers
DOD-STD 483A	Configuration Management Practices for Systems, Equipment, Munitions and Computer Programs
DOD-STD-490A	Specification Practices
MIL-STD-881A	Work Breakdown Structure for Defense Materiel Items
DOD-STD-1467	Software Support Environment
MIL-STD-1521B	Technical Reviews and Audits for Systems, Equipment and Computer Programs
ANSI/MIL-STD-1815A	Ada Programming Language
DOD-STD-2167	Defense System Software Development Standard

Military Specifications

MIL-S-52779A	Software Quality Assurance Program Requirements
MIL-S-83490	Specifications, Types and Forms

Directives

DODD 3405.2	Use of Ada in Weapons Systems
DODD 5000.1	Major System Acquisitions
DODD 5000.2	Major System Acquisition Procedures
DODD 5000.3	Test and Evaluation
DODD 5000.29	Management of Computer Resources in Major Defense Systems
DODD 5000.31	Interim List of DOD Approved High Order Programming Languages (HOL)
DODD 5200.1	DOD Information Security Program

Regulations

AR 25-1	Army Information Management Program
AR 25-5	Information Management for the Sustaining Base
AR 70-1	Research, Development and Acquisition System Acquisition Policy and Procedures
AR 70-10	Research and Development Test and Evaluation during Development and Acquisition of Materiel
AR 70-15	Research and Development, Product Improvement of Materiel
AR 70-37	Configuration Management
AR 70-XX	Draft, Management of Army Critical Computer Resources (MCCR)
AR 71-3	Force Development User Testing
AR 71-9	Materiel Objectives and Requirements
AR 380-5	DOD Information Security Program Regulation
AR 380-380	Automated Systems Security
AR 700-126	Acquisition Program Management

Pamphlets

DA Pamphlet 11-25	Life Cycle System Management Model (LCSMM) for Army Systems (draft, March 87)
DA Pamphlet 70-21	Research and Development, The Coordinated Test Program (CTP)
DA Pamphlet 700-26	Acquisition Program Management

Bulletins

TB 18-100	Army Automation Life Cycle Management

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Plans

Army Battlefield Interface Concept (ABIC)

CRMP, for the 155mm Self-Propelled Howitzer Improvement Program

CRMP, for Advanced Field Artillery Tactical Data System (AFATDS)

CRMP, for Light Helicopter Family (LHX)

Life Cycle Software Support (LCSS) Implementation Plan, DAMO-C4L Jan 84

See Appendix E.

Memorandums

DAMO-AFV-M, 7 July 87, Subject: Armored Family of Vehicles (AFV) Preliminary Computer Resource Management Plan (CRMP)

DAMO-AFV-M, 17 July 87, Subject: Armored Family of Vehicles (AFV) command, Control, Communications, Computer (C4) Mission support

DAMO-AFV-C, 17 July 87, subject: Armored Family of Vehicles (AFV) Integrated Command Control, Communications, Intelligence (C3I)

Guide

Messages

AMCDE-ATC, dtg: 181630Z Aug 87, subject: Armored Family of Vehicles (AFV) Preliminary Computer Resource Management Plan (CRMP), dated 26 Jun 87

DAMO-AFV-M, dtg: 030800Z Jun 87, subject: Armored Family of Vehicles (AFV) Automation and Communication Resource Working Group (ACRWG)

AMCDE-SB, dtg: 221410Z Nov 85, subject: Ada Policy

Field Manuals

FM 24-1, Combat Communication

FM 100-5, Operations

AMC Regulations

DARCOM-R 70-16, Management of Computer Resources in Battlefield Automated Systems

TRADOC Regulations

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Reader Comments

Readers are encouraged to send comments directly to:

Director
AFV Task Force
ATTN: DAMO-AFV-M (Maj Buckstad)
Fort Eustis, VA 23604-5597

Comments:

(Optional)
Name:
Address:
Office:
Telephone:

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AFV Task Force
ATTN: DAMO-AFV-M
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